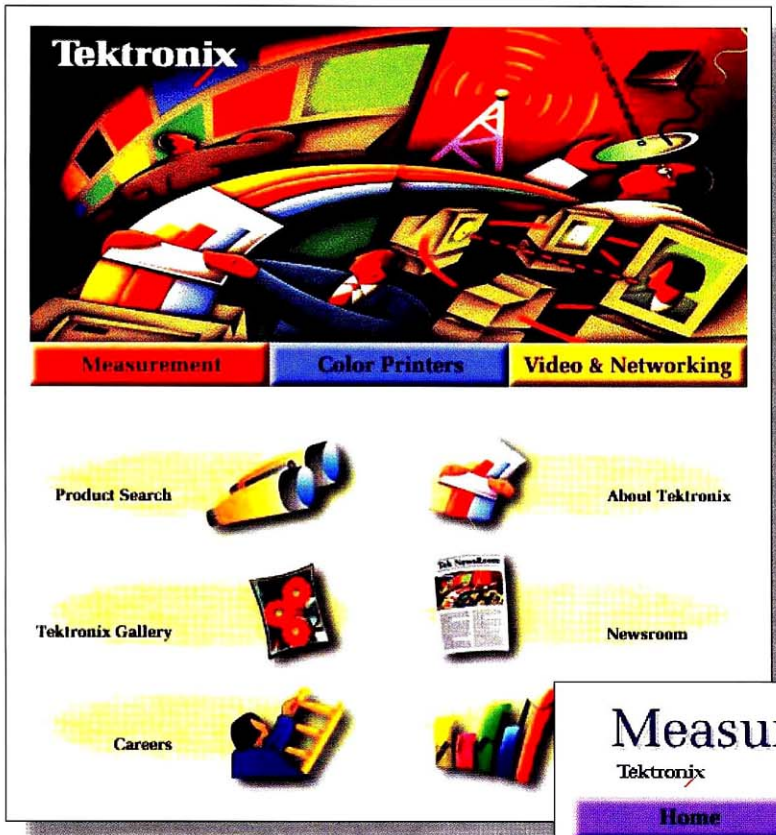
Tektronix

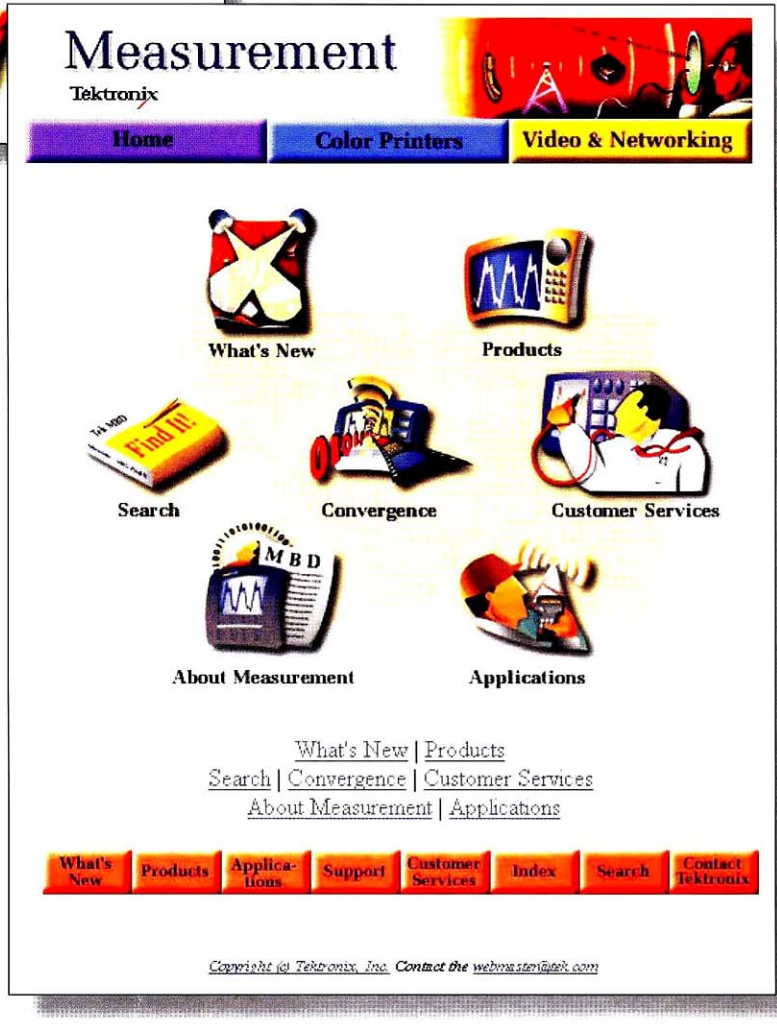
Measurement Products Catalog 1997/1998

http://www.tek.com



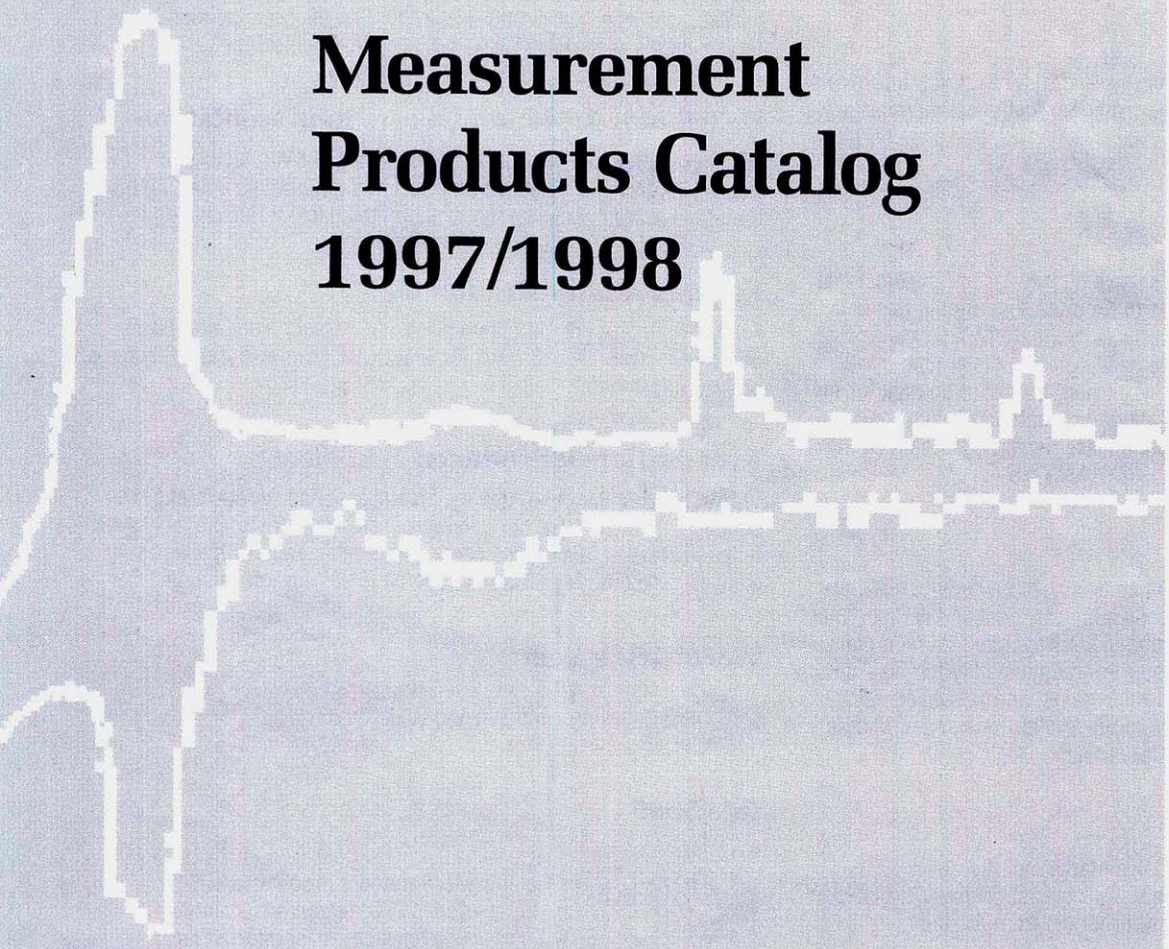
Tektronix is on the World Wide Web at **http://www.tek.com** Through this site you can access the latest information available about Tektronix products.

Keep up to date with news from Tektronix via the WWW! We publish our press releases in the What's New section the day they are released to the public, with links to available data sheets (for technical detail), application notes, published articles, and upcoming conferences, seminars, and shows worldwide.



Tektronix

Measurement Products Catalog 1997/1998



Tektronix: A Lifetime of Value

Customer Support

No other test and measurement supplier can match the remarkable depth of customer support offered by Tektronix. We offer technical support, service training, and service warranties. For additional information and the Tektronix representative nearest you, see the listing in the back of this catalog.

TEKFAX

Literature Available Via Fax

You can now receive information via fax—ideal for technical information you need immediately. Product information or application notes are available any time of the day via Tektronix TekFAX. See page 590 for complete information.

Advantest

In 1993 Tektronix became the exclusive distributor of Advantest test and measurement products in North America. Featured in this catalog are a wide-range of Advantest products in the RF/Microwave and Telecommunications areas. These exciting products are highly complementary to the Tektronix instrument portfolio. So look for the Advantest logo throughout this catalog to identify new high-performance, high-quality products from another leading company in the Test and Measurement industry: **ADVANTEST**

Rohde&Schwarz

Also, in 1993, Tektronix has assumed exclusive marketing, distribution, service, and support for Rohde&Schwarz Test and Measurement products in the U.S. Similarly, Rohde&Schwarz has assumed marketing, distribution, service and support responsibility for Tektronix Test and Measurement, Telecommunications, and Television Test products in Eastern Europe, most of the Mediterranean and Middle East, and the CIS. **ROHDE&SCHWARZ**

Analogic

In 1994 Tektronix assumed exclusive marketing, distribution, service, and support for Analogic VXI products world-wide. Listed in the VXI selection guide are the VXI products from Analogic.

Tektronix Sales/Service Offices

We have a worldwide network of sales and service offices. To find the office nearest you, see the listing in the back of this catalog.

Tektronix TeleBusiness Center (TBC)

The same quality support found in our sales and services offices is available toll free. Call 1-800-426-2200, Ext. 99, Monday through Friday, 8:00 a.m. Eastern Time to 5:00 p.m. Pacific Time.

Distributor & Manufacturers Representatives

We have Authorized Tektronix Distributors and Manufacturers Representatives for selective products and geographic areas. To find the office nearest you, see the listing in the back of this catalog.

Federal Administration Office

Federal Agencies should obtain price and delivery from, and place orders directly with, Tektronix Federal Order Administration. See page 580 for information.

Reconditioned Products: TekSelect™

Tektronix has a variety of quality, previously used products at prices significantly lower than our catalog prices. These products have been fully refurbished, tested and calibrated. Each comes with a warranty equivalent to our new products. See page 587 for information.

World Wide Web

See Tektronix on the World Wide Web:
http://www.tek.com

ISO 9000

ISO 9001 Tektronix Measurement products are manufactured in ISO registered facilities. See the inside back cover for information.

Copyright © 1997 Tektronix, Inc. All rights reserved. Printed in U.S.A. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks.

For further information, contact: Tektronix, Inc., Corporate Offices, 26600 SW Parkway, PO Box 1000, Wilsonville, Oregon 97070-1000. Phone (503) 682-3411, (800) 426-2200. Subsidiaries and distributors worldwide.

Prices and Specifications Subject to Change.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Recycled paper used for packaging and the body of this catalog.

Table of Contents

Alphanumeric Index **5-16**
Functional Index **17-24**
New Products/Worldwide Web **25-48**
Measurement Products **49-572**
- Oscilloscopes 49
- Logic Scope 115
- Logic Analyzers 119
- Spectrum Analyzers 145
- Network Analyzers 200
- Power Meters 205
- Signal Generators 219
- EMI/RFI Solutions 237
- Wireless Communication Test Sets 268
- Telecommunication Products 293
- VXI Systems, Controllers, Software 367
- Arbitrary Generators 389
- Stimulus Systems 401
- Data Generator 404
- Digital Multimeters 90, 412, 416
- Digital Counter 415
- Digital Thermometers 421
- Digital Clamp Meter 422
- Function Generators 413
- Power Supplies 408, 410
- Education Market Program 428
- Semiconductor Testers 431
- Accessories 438
  - Probes/Probe Accessories 439
  - Printer 522
  - Carts 524
  - Other Accessories 528
- Television Products 533
  - MPEG Test System 534
  - Measurement Sets 539
  - Waveform Monitors/Vectorscopes 542
  - Generators/Inserters 546
  - Audio 556
  - RF/Cable 562

Video Network Displays **573-578**
General Customer Information **579-609**
- General Business Information 579-580
  - TeleBusiness Center 579
  - Rental/Leasing Programs 579-580
  - Federal Government Customers 580
  - Terms and Methods of Payment 579
- Technical Support 579, 580, 581, 588
- Service Programs 581-586
  - Calibration Services 582
  - Warranty, Repair, Upgrades 584
  - Service Agreements, Service on Demand 586
- Reconditioned Instruments: TekSelect™ 587
- Training/Seminars 588
- Power Cords/Plugs 589
- Application/Technical Notes 590
- Worldwide Sales/Service Offices 591
  - Distributors/Representatives/Rental/Leasing Companies 596

Price List **610**

New Products .....see pages 25-44

Tektronix .....on the WWW!

See Tektronix on the World Wide Web: http://www.tek.com

Keep up to date with Tektronix. Access the latest information about products, publications, trade shows, and more.

Prices .....all in one place.

All prices have been consolidated into one section in the back of the catalog instead of appearing on individual pages. Makes looking up numerous prices easier and faster.

Your feedback is important to us!

In the back of the catalog is a mini-survey to let us know how we are doing and what we can provide to meet your changing needs. Just complete, mail, fax, or provide your input through the Tektronix WWW site.

Alphanumeric Index

AC220 TDS 200 Soft Case 89

ACL21 Alligator Clips 424

ACL22 Hook Clips 424

ACL23 Wire Clips 424

ACL24 Jaw Clips 424

AC11 *DMM Soft Case* *426*

AC12 *DMM Soft Case* *426*

AC13 *DMM Soft Case* *426*

ADA 400A Differential Amplifier 82, 498

AFTDS *Electrical Communication Adapter* *334*

AMT75 *Electrical Communication Adapter* *334*

AM 503B Current Probe Amplifier 509

AM 503S Current Probe Amplifier System 82, 509

AM 5030 Pgm. Current Probe Amplifier 509

AM 5030S Pgm. Current Probe Amplifier System 509

AM70 Handheld Analyzer/Generator 561

AM700 Mixed Signal Audio Measurement Set 559

ASG 100 Audio Signal Generator 557

ASG 140 Audio Signal Generator 557

ASW100F Audio Switcher, Input 561

ASW100M Audio Switcher, Output 561

ATK01 *Temperature Probe* Adapter *426*

ATLDX1 Lead Set 424

ATL01 Lead Set with Probes 424

ATL21 Basic Test Leads 424

ATL22 Basic Tip 424

ATL23 Extender Reach Tip 424

ATM150 ATM Analyzer 326

ATP01 *Bead Probe* *426*

AVTIME Audio to Video Delay Measurement Pkg. 540

AWG 2005 Arbitrary Waveform Generator 398

AWG 2021 Arbitrary Waveform Generator 396

AWG 2041 Arbitrary Waveform Generator 394

A01905 Sensor Cable 360

A08012 Connector Adapter, FC 360, 363

A08013 Connector Adapter, D4 ....360, 363

A08014 Connector Adapter, OF2 360

A08017 AC Power Adapter 360

A08019 AC Power Adapter 360

A08020 Bare Fiber Adapter 360

A08021 Adapter Cap 360

A08024 Bare Fiber Adapter, FC 360

A08025 Connector Adapter, AT&T Biconical 360

A08026 Connector Adapter, Diamond 2.5 360

A08027 Connector Adapter, Diamond 3.5 360

A08028 Connector Adapter, SMA 360

A08029 Connector Adapter, Siemens 360

A08030 Connector Adapter, Sumitomo 360

A08031 Connector Adapter, MBO 360

A08032 Connector Adapter, HFBR-4000 360

A08081 Connector Adapter, FC/PC 360

A08082 Connector Adapter, SC 360

A08083 Connector Adapter, ST 360

A08084 Connector Adapter, DIN 360

A08090 Connector Adapter, SC 360

A08095 Connector Adapter, SMA 2.5 360

Italics and color identifies NEW products.

Alphanumeric Index

A08096 Connector Adapter, ST 360
A08161 Connector Adapter, FC 360
A08162 Connector Adapter, SC 360
A08163 Connector Adapter, ST 360
A08186 Connector Adapter, Low Return Loss 360
A08187 Connector Adapter, FC 360
A1001 Blank Adapter 437
A1002 In-Line Adapter 437
A1003 TD3/TD66 Power Transistor Adapter 437
A1004 Offset Lead Adapter 437
A1005 Axial Lead Diode Adapter 437
A1007 Transistor Adapter 437
A1009 FET Adapter 437
A1010 IC Adapter 437
A1023 SMT Device Adapter 437
A1024 TD/SMT Device Adapter 437
A605 Current Probe 423
A610 Current Probe 423
A621 Current Probe 423
A622 Current Probe 423
A6302 50 MHz AC/DC Current Probe 511
A6312 *100 MHz AC/DC Current Probe 511*
A6302XL Current Probe 511
A6303XL Current Probe 511
A6303 15 MHz AC/DC Current Probe 511
A6304XL Current Probe 511
A6906S Fiber Optic Isolation System 502, 504
A6907 Monolithic Isolator 502
A6909 Monolithic Isolator 502
CableScout™ TDR Cable Tester for CATV 308
CDM250 Digital Multimeter 412
CFG253 Function Generator 413
CFG280 Function Generator w/Counter 413
CMC251 Frequency Counter w/Time Base 415
CMD53 *Rohde & Schwarz Communications Test Set 277*
CMD55 Rohde & Schwarz Communications Test Set 277
CMD57 Rohde & Schwarz Communications Test Set 289
CMD59 *Rohde & Schwarz Communications Test Set 286*
CMD80 Rohde & Schwarz Communications Test Set 269
CMM150 AC Clamp Probe 419
CMP500 Cable TV Measurement Pkg 562
CPS250 Power Supply 408
CrafTek™ Subscriber Loop Portable Test Set 310
CRTC02 Rohde & Schwarz Communications Test Set 274
CSA 803A Communications Signal Analyzer 95, 330
CSS500 Cable TV Measurement Pkg. Software 562
CTD55 *Rohde & Schwarz Communications Test Set 284*
CTS55 *Rohde & Schwarz Communications Test Set 282*
CTS 710 SONET/DS3/DS1 Test Set 314
CTS 850 *SDH/PDH Test Set 316*
CT-1 1 GHz Current Transformer 513
CT-100 CrafTek™ Portable Subscriber Loop Test Set 310
CT-2 200 MHz Current Transformer 513
CT-4 1,000 A Current Probe 513
DAS/NT Digital Analysis System – Networked 136
DAS/XP Digital Analysis System – Standalone 136

Italics and color identifies NEW products.

Alphanumeric Index

DAS9200 Digital Analysis System....136

DCS1000 *VXI Data Collection System....388*

DDS200 *Digital Demodulation System....570*

DG 2020 *Data Generator....404*

DL-11 Delay Line....106

DMM150 Pen Meter....418

DMM157 Handheld Digital Multimeter....418

DMM249 Handheld Digital Multimeter....418

DMM254 Handheld Digital Multimeter....418

DMM912 *Digital Multimeter....416*

DMM914 *Digital Multimeter....416*

DMM916 *Digital Multimeter....416*

DS1001 Demodulator....564

DS1200 Low Cost TV Demodulator System....563

DTM900 *Digital Thermometers....421*

DTM920 *Digital Thermometers....421*

DVT200 *Digital Video Transmitter....568*

ECO 422 Changeover Unit....548

EMC120 *EMI Measurement Software....239*

ESBI Rohde & Schwarz EMI Test Receiver....246

ESHS10 Rohde & Schwarz EMI Test Receiver....250

ESHS30 Rohde & Schwarz EMI Test Receiver....250

ES-K1 Rohde & Schwarz EMI Software....263

ESMI Rohde & Schwarz EMI Test Receiver....246

ESN Rohde & Schwarz EMI Test Receiver....258

ESPC Rohde & Schwarz EMI Test Receiver....264

ESS Rohde & Schwarz EMI Test Receiver....250

ESVB Rohde & Schwarz EMI Test Receiver....258

ESVD Rohde & Schwarz EMI Test Receiver....258

ESVN20 Rohde & Schwarz EMI Test Receiver....258

ESVN30 Rohde & Schwarz EMI Test Receiver....250

ESVS10 Rohde & Schwarz EMI Test Receiver....250

ESVS30 Rohde & Schwarz EMI Test Receiver....258

FiberChamp® Optical Power Meter....304

FiberMaster® Optical Time Domain Reflectometer....298

FMTAP™ FiberMaster® OTDR Trace Analysis Pkg....300

FSEA20 Rohde & Schwarz Spectrum Analyzer....149, 152

FSEA30 Rohde & Schwarz Spectrum Analyzer....149,152

FSEB20 Rohde & Schwarz Spectrum Analyzer....149,152

FSEB30 Rohde & Schwarz Spectrum Analyzer....149,152

FSEK20 *Rohde & Schwarz Spectrum Analyzer....148, 152*

FSEK30 *Rohde & Schwarz Spectrum Analyzer....148, 152*

FSEM20 *Rohde & Schwarz Spectrum Analyzer....148, 152*

FSEM30 *Rohde & Schwarz Spectrum Analyzer....148, 152*

gigaBERT® GB700 Pattern Generator & Error Detector....348

gigaBERT® GB1400 Pattern Generator & Error Detector....350

HC411 Thermal Printer....522

HFS 9DG1 Data Time Generator Card....401

HFS 9DG2 Data Time Generator Card....401

HFS 9003 Stimulus System....401

HFS 9009 Stimulus System....401

InstaVu™ Acquisition Mode....67

IPA 510 Interconnect Parameter Analyzer....108

IQSIM-K Rohde & Schwarz Simulation Software....230

K212 Portable Instrument Cart....527

K415 Transport Cart....526

Italics and color identifies NEW products.

Alphanumeric Index

K420 Work Bench Cart 525

K465 Instrument Tower 525

K475 Workstation Tower 526

LA-Browser™ Service Code Browser Software 139

LabVIEW Graphical Programming Software 384, 388

LabWindows Programming Environment Software 384, 388

LA-OffLine™ Offline Data Analysis Software 140

LVWIN LabVIEW for Windows 384, 388

LWCVI LabWindows CVI for Windows 384, 388

MCTAP Metallic Cable Trace Analysis Package 306

METRICS ICS Software 436

MTD 200 *MPEG Test Decoder* *535*

MTG 200 *MPEG Test Generator* *535*

MTS 100 MPEG Test System 534

multiBERT™ MB100 16 to 32 CH BERT 352

MXIEXT VXI-MXI Mainframe Extender 388

MXIWIN Standard VXI-MXI AT2010 388

NAP *Rohde & Schwarz Reflection Meter* *210*

NAS Rohde & Schwarz Directional Power Meter 208

NAS-Z1 RF Insertion Unit 217

NAS-Z2 RF Insertion Unit 217

NAS-Z3 RF Insertion Unit 217

NAS-Z5 RF Insertion Unit 217

NAS-Z6 RF Insertion Unit 217

NRVD Rohde & Schwarz Dual-CH RF Meter 212

NRVS Rohde & Schwarz RF Power Meter 214

NRV-Z1 Power Sensors 217

NRV-Z2 Power Sensors 217

NRV-Z3 Power Sensors 217

NRV-Z4 Power Sensors 217

NRV-Z5 Power Sensors 217

NRV-Z6 Power Sensors 217

NRV-Z7 Power Sensors 217

NRV-Z8 Power Sensors 217

NRV-Z31 Power Sensors 217

NRV-Z51 Power Sensors 217

NRV-Z52 Power Sensors 217

NRV-Z53 Power Sensors 217

NRV-Z54 Power Sensors 217

OA5002 Optical Attenuator 346

OA5012 Optical Attenuator 346

OA5022 Optical Attenuator 346

OA5032 Optical Attenuator 346

OCP 5002 Optical Converter/Power Meter 340

OCP 5502 Optical Converter/Power Meter 340

ORS2488 SDH/SONET Reference Receiver 342

ORS622 SDH/SONET Reference Receiver 342

PacketBERT™ PB200 Packet Generator & Error Detector 354

PPMS203B Articulated Arm 477

PS2520G Programmable Power Supply 410

PS2521G Programmable Power Supply 410

PS280 Triple Output Power Supply 408

P3410 *TTL Level Pod* *406*

P3420 *Variable Level Pod* *406*

P5100 250 MHz, 2.5 kV, 100X Probe 490, 492

P5102 100 MHz, 1 kV High Voltage Probe 427, 466, 490, 492

Italics and color identifies NEW products.

Alphanumeric Index

P5200 Active Differential Probe....82, 500

P5205 Active Differential High Voltage Probe....500

P5210 *Active Differential High Voltage Probe....500*

P6015A 75 MHz, 40 kV, 1000X Probe....468, 492

P6021 60 MHz Current Probe....514

P6022 120 MHz Current Probe....514

P6101B 15 MHz, 1X Probe....464

P6103B 60 MHz, 10X Probe....464

P6105A 100 MHz, 10X Probe....468

P6106A 250 MHz, 10X Probe....468

P6109B 100 MHz, 10X Probe....464

P6111B 200 MHz, 10X Probe....464

P6112 *100 MHz, 10X Probe....464*

P6114B *400 MHz, 10X Probe....464*

P6117 *200 MHz, 10X Probe....427, 464*

P6119B 1X/10X Switchable Probe....464

P6122 100 MHz, 10X Probe....468

P6129B 1X/10X Switchable Probe....464

P6131 300 MHz, 10X Probe....470

P6133 150 MHz, 10X Probe....470

P6134C 400 MHz, 10X Probe....470

P6135A 150 MHz, 10X Passive Differential Probe Pair....499

P6136 350 MHz, 10X Probe....470

P6137 400 MHz, 10X Probe....470

P6138A 400 MHz, 10X Probe....470

P6139A 500 MHz, 10X Probe....470

P6150 9 GHz, High BW, Low Impedance Probe....461

P6156 3.5 GHz, Low Z Probe....461

P6201 900 MHz, 1X/10X/100X, FET Probe....458

P6202A 500 MHz, 10X/100X, FET Probe....458

P6204 1 GHz, 10X, FET Probe....456

P6205 750 MHz, 10X, FET Probe....456

P6207 4 GHz, SMA FET Probe....460

P6217 4 GHz, TEKPROBE® FET Probe....456

P6243S Active Probe System....454

P6243 1 GHz Active Probe....454, 472

P6245 1.5 GHz, FET Probe....454, 472, 490

P6246 *Active Differential Probe....336, 496*

P6247 *Active Differential Probe....336, 496*

P6302 Current Probe (see A6302)....511

P6303 Current Probe (see A6303)....511

P6408 Word Recognizer Probe....515

P6561A *200 MHz, 10X SMD Probe....472*

P6562A *350 MHz, 10X SMD Probe....472*

P6563A *500 MHz, 20X SMD Probe....472*

P6701B *Optical-Electrical Converter....338*

P6703B *Optical-Electrical Converter....338*

P6711 Optical-Electrical Converter....338

P6713 Optical-Electrical Converter....338

P6723 *Optical-Electrical Converter....338*

P6751 Spatial Input Head....338

P850 10X Voltage Probe for 22X Oscilloscopes....492

Q32605 Advantest Optical Receiver Plug-in....356

Q81201 LED Source....363

Q81202 LED Source....363

Q81203 LED Source....363

Italics and color identifies NEW products.

Alphanumeric Index

Q81204 LED Source 363
Q81205 LED Source 363
Q81206 LED Source 363
Q81207 LED Source 363
Q81211 LED Source 363
Q81212 LED Source 363
Q82018 Power Sensor 360
Q82202 Interface Plug-in 363
Q82203 Interface Plug-in 363
Q82208 Power Sensor, High Sensitivity 363
Q8221 Advantest Optical Power Multimeter Mainframe....363
Q82214 Power Sensor, Short Wavelength....363
Q82215 Power Sensor, Long Wavelength 363
Q82216 Power Sensor, Large Area, High Sensitivity 363
Q8344A Advantest Optical Spectrum Analyzer 357
Q8347 Advantest Optical Spectrum Analyzer 361
Q8381A Advantest Optical Spectrum Analyzer 357
Q8383 Advantest Optical Spectrum Analyzer 357
RFM150 Signal Level Meter 566
R3261C Advantest Spectrum Analyzer 150, 173
R3261CN Advantest Spectrum Analyzer 150, 173
R3261D Advantest Spectrum Analyzer 150, 173
R3263 *Advantest Spectrum Analyzer* 150, 167
R3265A Advantest Spectrum Analyzer w/ Tracking Generator ..148, 161
R3271A Advantest Spectrum Analyzer w/ Tracking Generator ..148, 161
R3272 Advantest Spectrum Analyzer 148, 165
R3361C Advantest Spectrum Analyzer 150, 173
R3361CN Advantest Spectrum Analyzer 150, 173
R3361D Advantest Spectrum Analyzer 150, 173
R3365A Advantest Spectrum Analyzer 149, 162
R3371A Advantest Spectrum Analyzer 149, 162
R3463 *Advantest Spectrum Analyzer* 150, 167, 271
R3465 Advantest Spectrum Analyzer 149, 162, 271
R3561L *Advantest Source Simulation* 271
R3765AH Advantest Network Analyzer....201
R3765BH Advantest Network Analyzer....201
R3765CH Advantest Network Analyzer....201
R3767AH Advantest Network Analyzer....201
R3765BH Advantest Network Analyzer....201
R3765CH Advantest Network Analyzer....201
R4131D Advantest Spectrum Analyzer 150, 177
SA-42 Optical to Electrical Converter 344
SA-46 Optical to Electrical Converter 344
SDA 601 Handheld Serial Digital Analyzer 551
SD-14 High Impedance Probe Sampler 102
SD-20 Loopthrough Sampling Head 102
SD-22 Low Noise Sampling Head 102
SD-24 TDR Sampling Head....102
SD-26 Sampling Head....102
SD-32 Sampling Head....102
SD-42 Optical to Electrical Converter 102, 344
SD-46 Optical to Electrical Converter 102, 344
SD-51 20 GHz Trigger Head 102, 344
SF201 SureFoot® Interconnect for FET Probes 474
SF202 SureFoot® Interconnect for FET Probes 474
SF203 SureFoot® Interconnect for FET Probes 474

Italics and color identifies NEW products.

Alphanumeric Index

SF501 SureFoot® Interconnect for SMD Probes 474

SF502 SureFoot® Interconnect for SMD Probes 474

SF503 SureFoot® Interconnect for SMD Probes 474

SignalScout™ RFM150 Signal Level Meter 566

SIU 800 Static Isolation Unit 106

SJ300 SDH/SONET Analyzer 324

SMCK1 SOIC Clips 474

SME-K2 TDMA Software 224

SME02 Rohde & Schwarz 1.5 GHz Signal Generator 224

SME03E Rohde & Schwarz 3 GHz Signal Generator 224

SME03 Rohde & Schwarz 3 GHz Signal Generator 224

SMG50 SMT KlipChip Pkg. 474

SMHU58 Rohde & Schwarz 4.32 GHz Signal Generator 226

SMIQ *Rohde & Schwarz Signal Generator 220*

SMK4 *Micro KlipChip Adapter 474*

SMP02 Rohde & Schwarz 20 GHz Signal Generator 231

SMP03 Rohde & Schwarz 26.3 GHz Signal Generator 231

SMP04 Rohde & Schwarz 40 GHz Signal Generator 231

SMP22 Rohde & Schwarz 20 GHz Signal Generator 231

SMQK1 PLCC Quad Kits 474

SMT02 Rohde & Schwarz 1.5 GHz Signal Generator 233

SMT03 Rohde & Schwarz 3.0 GHz Signal Generator 233

SMT06 Rohde & Schwarz 6.0 GHz Signal Generator 233

SMY01 Rohde & Schwarz 1.04 GHz Signal Generator 234

SMY02 Rohde & Schwarz 2.08 GHz Signal Generator 234

SM-11 Multichannel Unit 106

SPG 1000 HDTV Sync Generator 553

SPG 422 Component Digital Master Sync Generator 548

ST112 Portable SONET Transmission Tester 320

ST2400 OC-48/STM-16 Generator/Analyzer 322

SureFoot® Surface Mount Device Interconnects 474

S26UT10 Utility Software 199

S3FT400 WaveWriter™ System Software 391

TCP202 *50 MHz Current Probe 507*

TDS 2CM Communications Extension Module 88

TDS 2HM Hardcopy Extension Module 88

TDS 2MM Measurement Extension Module 88

TDS 210 60 MHz Digital Real-Time Oscilloscope 50, 57, 87

TDS 220 100 MHz Digital Real-Time Oscilloscope 50, 57, 87

TDS 340A *100 MHz Digital Real-Time Oscilloscope 50, 57, 83*

TDS 360 *200 MHz Digital Real-Time Oscilloscope 50, 57, 83*

TDS 380 *400 MHz Digital Real-Time Oscilloscope 50, 57, 83*

TDS 420A 200 MHz Digitizing Oscilloscope 50, 57, 79

TDS 430A *400 MHz Digitizing Oscilloscope 50, 57, 79*

TDS 460A 400 MHz Digitizing Oscilloscope 50, 57, 79

TDS 510A *500 MHz Digitizing Oscilloscope 50, 57, 68-73, 77*

TDS 520C *500 MHz Digitizing Oscilloscope 50, 57, 68-73, 73*

TDS 540C *500 MHz Digitizing Oscilloscope 50, 57, 68-73, 73*

TDS 620B 500 MHz Digitizing Oscilloscope 50, 57, 74

TDS 640A 500 MHz Digitizing Oscilloscope 50, 57, 74

TDS 644B 500 MHz Digitizing Oscilloscope 50, 57, 74

TDS 680B 500 MHz Digitizing Oscilloscope 50, 57, 74

TDS 684B 1 GHz Digitizing Oscilloscope 50, 57, 74

TDS 724C *500 MHz Digitizing Oscilloscope 50, 57, 58*

TDS 754C *500 MHz Digitizing Oscilloscope 50, 57, 58*

TDS 784C *1 GHz Digitizing Oscilloscope 50, 57, 58*

Italics and color identifies NEW products.

Alphanumeric Index

TDS 820 6 GHz Digitizing Oscilloscope 64

TekRanger® TFS3031 Mini OTDR 302

TekScope® *THS 710A Handheld Battery Operated Oscilloscope/DMM 90*

TekScope® *THS 720A Handheld Battery Operated Oscilloscope/DMM 90*

TekScope® *THS 720P Handheld Battery Operated Oscilloscope/DMM 92*

TekScope® *THS 730A Handheld Battery Operated Oscilloscope/DMM 90*

TelScout® TDR Telephone Cable Tester....306

Test Station Instrument Workstation 527

TFC200 FiberChamp® Handheld Optical Power Meter....304

TFP2A FiberMaster® OTDR *298*

TFS3031 TekRanger™ Mini Optical Time Domain Reflectometer ..302

TG2000 *Signal Generator....546*

THS7CHG *Battery Charger....427*

THS7HCA *Hard Carring Case....427*

THS 710A *60 MHz Handheld Battery Operated Oscilloscope/DMM 90*

THS 720A *100 MHz Handheld Battery Operated Oscilloscope/DMM 90*

THS 720P *100 MHz Handheld Battery Operated Oscilloscope/DMM 92*

THS 730A *200 MHz Handheld Battery Operated Oscilloscope/DMM 90*

TLA510 100 CH Logic Analyzer....131

TLA520 200 CH Logic Analyzer....131

TLA704 *Portable Color Logic Analyzer Mainframe....120*

TLA711 *Benchtop Color Logic Analyzer Mainframe....120*

TLS216 Logic Scope 115

TOP130 Handheld Light Source....296

TOP140 Handheld Light Source....296

TOP150 Handheld Light Source....296

TOP200 Handheld Light Source....296

TOP220 *Handheld Light Source....296*

TOP300 Handheld Light Source....296

TQ82014 Power Sensor, Short Wavelength....359

TQ82015 Power Sensor, Ge 359

TQ82017 Power Sensor, Thin Wand....359

TQ8210 Advantest Handheld Optical Power Meter 359

TQ8325 Advantest Optical Wavelength Meter....366

TR4153B Advantest Tracking Generator 197

TR4154 Advantest Tracking Generator 197

TSG 100 NTSC Signal Generator 549

TSG 1001 Programmable Generator....553

TSG 111 PAL Signal Generator....549

TSG 120 YC/NTSC Signal Generator....549

TSG 130A NTSC Multiformat Generator....550

TSG 131A PAL Multiformat Generator 550

TSG 170A TV Test Signal Generator....552

TSG 170D Digital Composite Generator 547

TSG 200 NTSC Signal Generator 550

TSG 271 PAL TV Generator 552

TSG 422 Digital Component Generator....547

TSG 601 Handheld Serial Component Generator 550

TSG 95 Handheld Signal NTSC/PAL Generator....549

TS100 TelScout® TDR Telephone Cable Tester....306

TTiP Telecommunications Package and i-Pattern™ Software....66

Italics and color identifies NEW products.

Alphanumeric Index

TVS621A *VXI Waveform Analyzer 373*

TVS625A *VXI Waveform Analyzer 373*

TVS641A *VXI Waveform Analyzer 373*

TVS645A *VXI Waveform Analyzer 373*

TV110 CableScout™ TDR Cable Tester for CATV 308

TV1350 TV Demodulator 563

UPD04 Audio Analyzer 558

UPD05 Audio Analyzer 558

UPL *Audio Analyzer 558*

URV Z3 RF Probes 217

URV Z50 RF Probes 217

URV Z6 RF Probes 217

URV 35 Rohde & Schwarz RF Millivoltmeter 206

URV 5 Rohde & Schwarz RF Millivoltmeter 206

URV 5-Z1 RF Probes 217

URV 5-Z2 RF Insertion Unit 217

URV 5-Z44 RF Insertion Unit 217

URV 5-Z47 RF Insertion Unit 217

URV 5-Z7 RF Probes 217

U3641 *Advantest Spectrum Analyzer 150, 179*

U3641N *Advantest Spectrum Analyzer 150, 179*

U4342 *Advantest Spectrum Analyzer 150, 179*

U4342N *Advantest Spectrum Analyzer 150, 179*

U4941 Tektronix/Advantest Spectrum Analyzer 151, 179

U4941N Tektronix/Advantest Spectrum Analyzer 151, 179

VITS 100 NTSC Generator/Inserter 554

VITS 200 NTSC Generator/Inserter 554

VITS 201 Insertion Generator 554

VMBKUP Backup and Remote Control Software 540

VMREMGR Remote Graphics Software 540

VMT Remote Control Software 540

VM100 Automatic Video Measurement Set 541

VM 700T Video Measurement Set 539

VXIGPIB Resource Manager 388

VXI-MXI VXI-MXI Mainframe Extender 388

VXI700 100 MHz Single-shot Embedded 486DX4 Controller 383, 388

VXI700E Enchanced 100 MHz Single-shot Embedded 486DX4 Controller 383, 388

VXI833 133 MHz Embedded Pentium Controller 383, 388

VXI866 166 MHz Embedded Pentium Controller 383, 388

VX0A41 VXI Programmable Optical Attenuator 328, 388

VX1406 VXI C-Size Mainframe 370, 388

VX1410 VXI C-Size Mainframe 370, 388

VX1411 *VXI C-Size Mainframe 370, 388*

VX4GBD 4 GB Hard Disk Drive 388

VX4101 *VXI DMM/Counter 377, 388*

VX4234 VXI 4.5 Digit Digital Multimeter 377, 388

VX4237 VXI 6.5 Digit Digital Multimeter 377, 388

VX4240 VXI Waveform Digitizer/Analyzer Module 388

VX4244 Digitizer 388

VX4286 Digital Input/Analog Comparator 377, 388

VX4287 VXI Differential Input A/D Convertor 377, 388

VX4320 Six 1x4 RF Multiplexer 380, 388

VX4330 Scanner 380, 388

VX4342 Programmable Resistance 388

VX4350 Switching Module 380, 388

Italics and color identifies NEW products.

Alphanumeric Index

VX4351	*Switching Module*	*380, 388*
VX4353	SPST Relay Switch	380, 388
VX4357	SPDT Relay Switch	380, 388
VX4380	Matrix	380, 388
VX4381	*Matrix*	*380, 388*
VX4428	ARINC 429 Quad Transmitter/Receiver	382, 388
VX4469A	ARINC 629 Simulator w/Enhanced Error Injection	382, 388
VX4510	*Controller*	*388*
VX4780	*Controller*	*388*
VX4730	12 Channel DAC	378, 388
VX4750	Function Generator	378, 388
VX4790A	Arbitrary Waveform Generator	378, 388
VX4801	Isolated Digital I/O	379, 388
VX4802	Programmable Digital I/O	379, 388
VX4820	Digital Test Module	379, 388
WaveStar™	*Electronic Lab Notebook Software*	*86, 112*
WaveWriter™	Waveform Creation & Editing Software	391
WFM 300A	Component/Composite TV Waveform Monitor	544
WFM 601A	*Serial Component Monitor*	*544*
WFM 601E	*Serial Component Monitor with Eye Pattern*	*544*
WFM601M	*Serial Componet Measurement Set*	*544*
WFM 90	Waveform/Vector/Picture/Audio Monitor (NTSC)	544
WFM 91	Waveform/Vector/Picture/Audio Monitor (PAL)	544
WSTR31	*WaveStar™ Electronic Lab Notebook Software*	*86, 112*
WVR 500	Waveform/Vector Rasterizer	545
YT5100	1X/10X 100 MHz	467
YT5060	1X/10X 60 MHz Passive Probe	467
1101A	Probe Power Supply	458
1103	TEKPROBE® Power Supply	456
11801B	Digital Sampling Oscilloscope	95, 97
119-4833-00	Microscope Assembly	476
1405	TV Sideband Adapter	195
1502C	TDR Cable Testers	305
1503C	TDR Cable Testers	305
1705A	Spectrum Monitor	572
1710J	*Waveform Monitor*	*543*
1711J	*Waveform Monitor*	*543*
1720	Vectorscope	542
1720 SCH	NTSC Vectorscope	542
1721	Vectorscope	542
1721 SCH	PAL Vectorscope	542
1725	PAL/NTSC Vectorscope	542
1730	NTSC Waveform Monitor	542
1730 D	NTSC Serial Digital Waveform Monitor	542
1731	PAL Waveform Monitor	542
1735	PAL/NTSC Waveform Monitor	534
1735 HD	Multiformat Waveform Monitor	543
1740A	NTSC Waveform/Vector Monitor	543
1741A	PAL Waveform/Vector Monitor	543
1745A	NTSC/PAL Waveform/Vector Monitor	543
1750A	NTSC Waveform/Vector Monitor	543
1751A	PAL Waveform/Vector Monitor	543
1755A	NTSC/PAL Waveform/Vector Monitor	543
1760	NTSC Composite/Component Waveform/Vector Monitor	543
1761	PAL Composite/Component Waveform/Vector Monitor	543

Italics and color identifies NEW products.

Alphanumeric Index

1765 PAL Composite/Component Waveform/Vector Monitor....543

1780R Video Measurement Set....541

1781R Video Measurement Set....541

1910 Digital Generator/Inserter....554

2704 Inverter....198

2705 Battery Pack....198

2706 Stepping RF Preselector....243

2707 External Tracking Generator....196

2711 Portable Spectrum Analyzer....151, 184

2712 Portable Spectrum Analyzer....151, 184

27120A EMC Measurement System....239

2714 Cable TV Spectrum Analyzer....151, 188, 572

2715 CATV Spectrum Analyzer....151, 188

2721A Non-interfering Sweep Transmitter....572

2722A Non-interfering Sweep Receiver....572

370A Programmable Curve Tracer....432

371A Programmable Curve Tracer....434

73A-270 VXI Pulse/Pattern Generator....378, 379, 388

73A-308 VXI Relay Driver Module....380, 388

73A-451 Wire Wrap Module....388

73A-452 Blank Wire Wrap....388

73A-455 MIL-STD-1553 Simulator Tester....382, 388

73A-541 VXI Universal Digitizer Counter....377, 388

73A-850 Extender....388

73A-851 VME to VXI Adapter Module....388

760A Stereo Audio Monitor....557

760D Stereo Audio Monitor....557

760N Stereo Audio Monitor....557

764 Digital Audio Monitor....556

92A96UD 100 MHz Acq. Card, 2M Deep....137

92C96 100 MHz Acq. Card, 32K Deep....137

92C96D 100 MHz Acq. Card....137

92C96XD 100 MHz Acq. Card....137

92C96SD 100 MHz Acq. Card....137

92LANP LAN Pgm. Control Language Software....141

92FXNET Upgrade to DAS NT....137

92FXSE Upgrade to DAS XP....137

92LANP LAN PCL Software....141

92PA Performance Analysis Software....141

92PORT DAS® Target Control Software....141

92SIMLK *Simulation Translation Software....141*

92S16 50 MHz Pattern Generator....137

92S32 50 MHz Pattern Generator....137

Italics and color identifies NEW products.

Signal Generators
New SMIQ

Features

SMIQ

- Frequency Range
  300 kHz to 3.3 GHz (SMIQ03)
  300 kHz to 2.2 GHz (SMIQ02)
- Broadband Analog I/Q Inputs
- NADC, GSM, PHS, CDMA Digital Modulation Formats (optional)
- Superior Modulation Accuracy and Stability
- Wideband AM
- Excellent Spectral Purity
- High Level Accuracy
- Frequency and Phase Modulation (optional)
- Fading Simulator in Conformance to Communications Systems Specifications (optional)
- Universal Modulation Coder for Custom-Designed Digital Modulation (optional)

Applications

- Wireless Component Design and Test
- Manufacturing Test
- Mobile Phone Design and Test
- Base Station Design and Test
- Digital Video Component and System Design, Test

New SMIQ Vector Signal Generator.

SMIQ Vector Signal Generator

The new SMIQ Vector Signal Generator covers a frequency rage from 300 kHz to 3.3 GHz. With superior modulation accuracy and excellent spectral purity, the SMIQ sets a new standard in the signal generator field for digital modulation applications.

The built-in I/Q modulator with a bandwidth of 30 MHz guarantees the highest modulation quality and versatility for all digital modulation formats for all in-channel and out-of-channel applications.

HIGH SPECTRAL PURITY
The SMIQ series offers the needed high spectral purity for demanding digital modulation and analog modulation applications. They provide the spectral purity required for sensitivity measurements or adjacent channel selectivity measurements.

SUPERIOR VECTOR ACCURACY OVER THE COMPLETE FREQUENCY RANGE
Making measurements of digital receivers with minimal measurement uncertainty requires a test source with excellent vector accuracy. The SMIQ generator provides superior precision of the I/Q modulator over the entire frequency range.

SIGNAL GENERATION FOR DIGITAL STANDARDS
With options SMIQ-B10 and SMIQ-B11, setup of PHS, GSM and NADC signals is automatic. Data frames and time slots can be easily edited with a graphical interface. Power ramping, symbol rate and baseband filtering can be varied for design limit testing.

CDMA signals for IS-95 testing are provided with option SMIQ-B42. Forward and reverse link signals are included for base station or mobile unit signals.

FADING SIMULATION FOR DIGITAL WIRELESS APPLICATIONS

A unique feature of the SMIQ series is the fading simulation in conformance to communication standards. The fading options add six- or twelve-path functionality for one or two RF channels. Recommended fading statistics such as Rayleigh, Rice, and Log Normal are also provided as standard settings which characterize the environmental situation.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987 with SCPI 1993.0.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Functional Index

Cable TV, RF Spectrum Analyzer Optical Plug-in **356**
Cable TV Sweep System **572**
Cable Testers **188, 305, 572**
Metallic 305
CATV/Broadband Sweep 188, 572
Cables **338, 516**
BNC, BSM, SMA (3 mm and 3.5 mm) 516
Coaxial 516
GPIB Interface (RS-232, GPIB, Centronics) 516
Optical Fiber 338
Patch Cords 516
Calibration Services **582**
Camera Measurement Set **539**
Capacitors, Coupling (SMA) **520**
Card Modular Systems (VXI) **367-388**
Carrier-to-Noise Measurement, Optical **356**
Carrying Cases **528**
Carts **524-527**
CATV **188, 572**
Centronics Cables **517**
Changeover Unit, Digital **548**
Coaxial Cables **516**
Communication Interfaces **49-390**
GPIB
Communication Test Sets 268-292
EMI Field Strength 246
EMI/Radio Monitoring Solutions 258
Logic Analyzers 119-144
Logic Scope 115-117
Oscilloscopes 49-107
Preselector 243
Power Meters 205-218
Signal Sources 219-236, 390
Spectrum Analyzers 145-199
RS-232
EMI/RFI Solutions 237
Power Meters 205-218
Signal Sources 219-236, 390
VXI 367-388
Communications Signal Analyzers **330**
Communications Test Equipment ***see Telecommunications***
Communications Test Sets **368-292**
Component Checker, Handheld **412, 416**
Component Tester **412, 416**
Connectors **519**
Controllers **367-369, 383**
Converters 338-347, 563
Optical-to-Electrical 338-347, 563
Tunable/Fixed Down Converter, Television RF 563
Counters **415**
Oscilloscope 68, 74, 79
Coupling Capacitors (SMA) **520**
Current Probes **505-514**
Curve Tracers **431-437**
Adapters 437
Probes 438-532
Customer Information **579-632**
Application/Technical Notes 590
Federal Customers 580
General Business Information 579-580
Leasing Program 580
Order Information see Individual Product Pages
Power Cords/Plugs 589
Price List 596
Reconditioned Instruments: TekSelect™ 587
Rental Program 580
Sales & Service Location Listing 591-595
Service 582-586
Technical Support 581-586
TeleBusiness Center 579
Terms and Methods of Sale 579
Training/Seminars 588
Customer Service/Support **579-595**
Customer Training/Seminars **588**

D

Data Generators (also, ***see Generators)*** **404**
Data Time Generators ***see Generators***
Delay Lines (SMA) **517**
Demodulators, Television **564**
DC Coupled Current Probe **507**
Differential Preamplifier **82, 498**
Differential Probes **496, 504**
Digital Clamp Meter **422**
Digital Multimeters (DMM) **412, 416-420**
Handheld Digital Multimeters 416-420
Bench Digital Multimeters 412
Digital Signal Analyzers **330**
Digital Signal Processing Systems **145-292, 330, 384, 351**
Analyzers 551
Oscilloscopes 330
Software 384
Spectrum Analyzers 145-292
Digital Test Instruments **367**
Digital Thermometers **421**
Digital Video Transmitter **568**
Digitizers ***also see Oscilloscopes*** **119, 372, 438-532**
Accessories 438-532
Logic Analyzer Based 119
Systems 372
VXI 372
Waveform 372

Functional Index

Diode, Edge Emitting **363**
Distributors **596**
Down Converters, Television RF **188, 572**

E

Education Support **428-430, 588**
Hands-on Instruction 428-430
Self-Study 429
Seminars 588
Training 588
Video Tapes 430
EE LED **363**
EMC Screen Filters **532**
EMI, Field Strength **246**
EMI Measurement Systems **239**
EMI/RFI Solutions **237**
EMI/Radio Monitoring **258**
EMI Test Software **239, 263**
Encoder, PAL **554**
Error Detector, SDH/SONET **348-355**

F

FET Probes **454-460, 474**
FFT **456**
Fiber Adapter, Optical **359, 363**
Fiber Optic Power Meter **359-362**
Fiber Optic, RF Spectrum Analyzer Plug-in **356**
Fiber Optic Spectrum Analyzer **362**
Fiber Optics **293, 356-366**
Filters **532**
EMC Screen 532
Light 532
Mesh 532
Fixtured Probes **474-476**
Floating Measurements **502-504**
Frequency Counter, Optical Wavelength **366**
Frequency Counters **415**
Function Generators **413**
Furniture *also see Carts*
Carts 524
Work Station 524

G

Generators, Signal **119, 135, 184, 219-236, 312-323 389-406, 517, 536, 542, 546-555, 557, 561**
Arbitrary Waveform 230, 389-409
Audio 547-555, 557
CATV 549
Component–Serial, Analog, NTSC, PAL, Digital 546, 547, 550-552
Data 401, 404
Data Time 401
Digital Component 551, 547
Digital Composite, NTSC 547
Digital Modulated 220
Digital Word 119, 135
Function 549-555
Ghost Canceler Reference 553-555
Handheld 551, 561
High Definition Sync, Test Signal, Waveform Monitor 542, 553-555
Insertion 553-555
IQ Modulated 220
Microwave Signal 2219-236
MPEG 536
Pattern 401, 547, 553
Programmable 553
Pulse 389-406
Pulse/Function 401
SDH/SONET 312-323
Sync 547, 553
Television Test Signal 549-555
Tracking 184
Word 401
GPIB Cables **517**
Ground Leads, Probe **478-521**

H

Handheld Products **90, 92, 200, 233, 304, 359, 416-421, 422-427, 544, 551, 549**
Accessories 423-427
Analyzer 551
Audio Analyzer/Generator 551
Generator 549, 559
RF 200
RF Sources 233
Monitor 544, 559
Multimeters 416-420
Digital Theremeters 421
Optical Power Meter 304, 359
Oscilloscopes 90,92
Digital Clamp Meter 422
High Definition
Programmable TV Generator 553
Television Oscilloscope 68, 74, 79
Television Sync Generator 553
Waveform Monitor 542
High Resolution Spectrum Analyzer, Optical **361**
High Voltage Probes **456, 492, 500**
Hoods, Scope and Video Viewing **530**

I

IC Clips **474-476**
PLCC Packages 474-476
PQFP Packages 474-476
SOIC Packages 474-476
Indices **4-24**
Alphanumeric 5
Functional 17
Inserts/Gernerator **546**
Instrument/System Controllers **367-388**
Instrument/Probe Reference Chart **442-443**

Functional Index

Instruments, Reconditioned **587**
Instruments, Stimulus **367, 383**
Instruments, Switching and Scanning **367**
Interface Cables **516**

J

Jitter Analyzer, SDH/SONET **324**

L

Leasing Program **580**
Light Emitting Diode **363**
Light Filters **532**
Light Measurement **293, 357, 359, 363, 366**
Fiber Optic 293, 357, 359, 363, 366
Line Impedance Stabilization Network (LISN) **244**
Literature, Application Notes **590**
Logic Analyzers **119-144, 438-532**
Accessories 438-532
Digital Analysis Systems 135
GPIB 142
High Speed Timing 142
Microprocessor 119, 142
Disassembly 135, 142
Support 142
Logic Scope **115-117**
Low Capacitance Probes **461**
Low Impedance Voltage Probes **461**

M

Mainframes
Logic Analyzers 120, 135
Oscilloscopes 97
Systems 370
Measurement Instruments, Systems **367, 377, 388**
Meter, Optical Power **359, 363**
Meter Leads **516**
Meter, Power **205**
Meter, RF **205-218**
Microprocessor Support Products **142**
Microwave & RF Instruments **145-292, 356, 438, 572**
Accessories 145-292, 438
Communications Test Sets 268-292
EMI/RFI Solutions 237-267
Signal Generators 219-236
Software 199, 239, 263
Spectrum Analyzer Optical Plug-in 356
Spectrum Analyzers 145-199, 237-267
Spectrum Monitor 572
Sweep Generator 219
Mobile Radio Test Sets **268**
Modular Instruments **340, 342, 363, 401**
Optical Converter/Power Meter 340, 363
SDH/SONET Reference Receivers 342
Signal Sources 401
Modulation Analyzer **152, 167**
Monitors **542, 549, 557, 572**
Spectrum 572
Stereo Audio 557
Waveform 542, 549
MPEG Test System **534**
MPEG Test Generator **536**
MPEG Test Decoder **538**
Multimeter, Optical Power **363**

N

New Products **25-48**
Network Analyzers **200**

O

Optical see Opto-Electronic Instruments
Optical Attenuators **328, 346, 367**
Optical-to-Electrical Converters **338-347, 357**
Optical Power Meter **340, 359, 363**
Optical Receiver, RF Spectrum Analyzer Plug-in **356**
Optical Reference Receivers, SDH/SONET **342**
Optical RF Spectrum Analyzer Plug-in **356**
Optical Source **363**
Optical Spectrum Analyzers **356, 361**
Optical Wavelength Meter **366**
Opto-Electronic Instruments **102, 298-309, 328, 338, 340 344, 346, 359, 363**
Cable Testing, Optical 298-309, 346
Electrical-to-Optical Converters 346
Optical Attenuator 328, 346
Optical-to-Electrical Converters 102, 338, 340, 344
Heads 102, 344
Instruments 340
Modules 344
Probes 338
Power Meter, Optical 340, 359, 363
Spatial Optical Fiber Input Head 338
Oscilloscopes **49-108, 112, 119-144, 293, 330, 384, 438-532, 544**
Accessories 438-532
Battery Operated 90, 92
Carts 524
Communications Signal Analyzer 330
Digital Sampling 330
Digital Storage 49-107, 330
Digital/Optical Communications 330
DMM 90, 92
Handheld 90, 92, 544
Hardcopy Output *see Printers*
Logic Analyzer Based 119-144
Mainframes for Modular Plug-Ins 108, 330
Modular 330
Optical-to-Electrical 293, 330
Plug-Ins 102-107
Portable 49-101

Functional Index

Printers/Plotters 522
Probes....438-521
Rackmount....49-101
Rackmount Kits 531
Sampling 102, 106, 330
Accessories....106
Delay Line....106
Digital....330
Heads....102
Multi-Channel Unit 106
Software 112, 384
Storage 49-101, 330
Digital 49-109
Variable Persistence....330
Service....79-93
Telecommunications....330
Television....74, 79
Training 428, 588
Travel Accessories....528
Viewing Accessories....530

P

Passive Voltage Probes 462
Patch Cords 516
Pattern Generator....120, 131, 348-355, 401
SDH/SONET 348-355
Physical Measurement Instruments
Fourier Analyzers....357
Picture Monitor, Handheld....544
Plug-in, RF Spectrum Analyzer, Optical 356
Power Dividers (SMA) 519-521
Power Meter, Optical 340, 359, 363
Power Meters, RF 205
Power Plug Options 589
Power Sensors 216
Power Supplies 408-411, 456, 458
Pre-/Post-Certification Software 239
Pre-/Post-Certification System....239
Prequalification Software....239
Preselector, RF Stepping 240
Price List 610
Printers, Thermal....522
Probes 142, 244, 338, 438-532
1X-10X Switchable 462
Accessories 478-489, 516-521
Active (FET, Bipolar, Bias/Offset) 452-461, 474
Adapters/Attenuators 478-489, 519-521
Articulated Arms/Probing Stations 477
Current....505-513
Current Amplifiers 509
DC Coupled Current Probe 507
Differential....496-501
Discontinued Instruments....444-451
EMI Probes....244
FET 454-460, 472
Ground Leads....478-521
High Current....505-514
High Frequency 453-460
High Voltage....492, 500
Instrument/Probe Reference Chart 442
Isolators....502-504
Low Capacitance 461
Low Impedance 461
Low Loading....453, 461
Microprocessor/Bus Probe Adapter 142
Obsolete Probe to Replacement Probe Cross Reference....444-451
Optical-to-Electrical Converters 338
Oscilloscope to Probe Cross Reference....442
Passive Voltage 462-473
Probing Stations/Articulated Arms 477
Replacement Parts 478
RF 216, 244
SMT Device Probe/Interconnects 474-476
Specification Chart 448
Voltage....448, 452-462, 472
Active....452-460, 472
Low Impedance....461
Passive....462
Reference Chart 448
Word Recognizer/Trigger....515
Probing Stations/Articulated Arms 477
Programmable DMM....416-420
Pulse Generators 401

R

Rackmount Products 49-101, 119-144, 195, 205-219, 268-292 320-326, 348-355, 389, 436-527, 531
ATM Analyzer....326
Bit Error Rate Testers 348-355
Carts 524-527
Communication Test Sets....268-292
Kits 531
Oscilloscopes....49-101
RF Meters....205-218
Signal Sources 219, 389
SDH/SONET Test Set....320-325
Spectrum Analyzer....119-144
TV Sideband Adapter....195
Radio Communication Test Sets 268
Radio Test Sets, Mobile 268
Rasterizer, Waveform/Vector 545
Receiver, Spectrum Analyzer Optical Plug-in....356
Receivers, SDH/SONET....342
Reconditioned Instruments: TekSelect™....587
Reference Information 49-60, 70, 74, 90, 119, 142, 145-151, 205 219, 237, 268, 367, 389, 409, 411, 414, 416, 419 421, 428-430, 439, 442, 444-451, 448, 520, 524, 589
Arbitrary Generators....389
Attenuator Selection Guide 520

Functional Index

Cart Selection Guide 524
Communication Test Sets 268
Digital Multimeter Selection Guide 414, 416, 419
Digital Thermometers 421
EMI/RFI Solutions 237
Function Generator Selection Guide 414
Instrument/Probe Chart 442
Logic Analyzer 119
Microprocessor Support Selection Guide 142
Microwave and RF 145, 148-151
Obsolete Probes to Replacement Probes 444-451
Oscilloscopes 49-60, 70, 74, 90
Oscilloscope to Probe Cross Reference 442
Power Plug Options 589
Power Supplies 409, 411
Probe Selection/Tutorial 439
RF Meters 205
RF and Wireless Test Products 145
Self-Study Programs 428-430
Signal Sources 219
Spectrum Analyzers 145, 148
Systems 367
Voltage Probe Reference Chart 448

Relative Intensity Noise, Spectrum Analyzer Plug-in 356

Rental Companies 579, 580, 608

Rental Program 579, 580

Repair, Upgrade, Warranty Services 584

Representatives 608

RF Insertion Units 216-218

RF Meters 205-218

RF Probes 244-216

RF Products
Cable TV Measurement Packages/System Software 188, 562, 572
Cable TV Spectrum Analyzer 188, 562, 572
Demodulator 563
Probes 244
Power Meters 205
Signal Level Meter 566
Signal Generators 219, 389
Spectrum Monitor 188, 572
Spectrum, Optical 356
Sweep Transmitter 188, 572
Sweep Receiver 188, 572
Radio Communication Test Sets 268

RF Spectrum, Optical 356

RIN (Relative Intensity Noise) Spectrum Analyzer Plug-in 356

RS-232-C Cables 516

S

Sales & Service Offices 591-595

Sampling 102, 106, 293, 330, 340
Accessories 106
Delay Line 106
Digital 330
Heads 102
Multi-Channel Unit 106
Optical to Electrical Head 102, 344

Scanners, VXI 367

SDH Portable Test Set 320-325

SDH/PDH Test Set 312, 316

SDH/SONET Analyzer 320, 325

SDH/SONET Reference Receivers 342

SDH/SONET Test Sets 320-325

Selection Guides *see Reference Information*

Self-Study Programs 428-430

Semiconductor Testers 431-437
Curve Tracers 431-435
Socket Adapters 437
Software 436

Seminars 588

Serial Digital 542, 544, 549
Video Interface 549
Waveform Monitor 542, 544

Service Information 581-586
Agreement and On-demand 586
Calibration 582
Options 585
Warranty, Repair and Upgrade 584

Service Oscilloscopes 79, 90, 92

Service Training/Seminars 588

Sideband Adapter 195

Signal Analyzers 97, 330, 551

Signal Generators *(also see Generators)* 219
Digital Modulated 220
RF Sources 233
IQ Modulated 220

Signal Level Meter 566

Signal Sources 219-236, 390, 549
Software 230

SMA 484, 516, 579, 520
Adapters 484, 519
Attenuators 520
Cables 516

SMD Probe/Interconnects 474

Software 112, 119-120, 131, 139-141, 199, 230 239, 263, 367, 384, 385, 391, 539
Debug Tools 119, 120, 131, 139, 140
EMI Testing 239, 236
EMI Prequalification 239
Arbitrary Generators 391
Oscilloscope 112, 384
Performance Analysis 141
Signal Acquisition and Analysis 391
Spectrum Analyzer 199, 230, 239, 263
System 367, 384
Technical Support 367, 385
VM700T Remote Graphics 539
VM700T Backup and Remote Control 539

Functional Index

VM700T Remote Control 539
VXI 367, 384
Waveform Generation 391

SONET/DS3/DS1 Test Sets 312, 316

SONET Portable Test Set 320-323

Spectrum Analyzers 102, 145-199, 216, 239, 243, 244, 263, 344 356, 361, 438-532, 562, 572
Accessories 145-199, 244, 438-532
Battery Powered 179
Cable TV Analyzer 188, 572
Cable TV Measurement Packages/System Software 188, 562
Full-Range Microwave 161, 152, 165, 167, 173
Modulation Analyzers 157, 167
Optical-to-Electrical Converter 102, 344
Optical Spectrum 356, 361
PC-Based Systems 239
Plug-in, Optical 356
Portable 145, 152, 161, 165, 167, 179, 184, 188
Preselector 243
Probes, RF 216, 244
Software 199, 239, 263
Tracking Generator 173, 196, 198
TV Sideband Adapter 195

State Analyzer 119

Stimulus Systems/Instruments 367, 401

Sweep System, Cable TV 188

Switching and Scanning Instruments 367, 380

System Controllers 367, 383

Systems 367, 388
Avionics 382
Cables/Connectors 386
Controller/Interface 383
Digital 379
Digitizers 372
General Information 368-369
Instruments 377
Mainframes 370
Software 384
Sources 378
Summary 388
Support/Service 385
Switching/Scanning 380
System Architecture 369

T

Technical Support 581, 582, 588

Telecommunications Test Equipment 119, 145-199, 237-244, 269-273, 305, 312, 320-324, 326, 330, 338-345, 348-358, 361-362, 366-637, 438-532
Accessories 338, 438-532
ATM Analyzer 326
Bit Error Rate Test Set 348-355
Cable Testing, Optical 346
Communications Signal Analyzer 269-273, 330, 367
Electrical-to-Optical Converters 346
LAN Media Testing 305
Metallic Cable Testers 305
Modulation Analyzers 152, 167
Optical Attenuator 346, 367
Optical Cable Testing 346
Optical-to-Electrical Converters 338-345, 356
Optical Probes 338
Optical Spectrum Analyzers 357, 361
Optical Wavelength Meter 366
Probes 438
RS-232 Analyzer 119
SDH Test Set 312, 316
SDH/SONET Analyzer 324
SDH/SONET Jitter and Wander Analyzer 324
SDH/SONET Test Set 320-323
SONET Test Set 312, 316
Spectrum Analyzers 145-199, 237-244, 356-358, 362
Waveform Analyzer 119

Telecommunications Testing 312-316

Television Test Equipment 533-572
Accessories 438-532
Audio Analyzers 558, 560
Audio Measurement Set 539, 559
Cable TV Spectrum Analyzer 188, 356, 572
Demodulators 563, 570
Digital Video Transmitter 568
Sideband Analyzer 195
Generators 536, 547-555, 561
Audio Signal 547-555, 561
Handheld Test Signal 549, 551
Insertion 553
MPEG Test 536
Serial Digital Video Interface 551
Test Signal Generators/Inserters 547-555
MPEG Test System 534
MPEG Generator 536
MPEG Decoder 538
Sideband Adapter 195
Spectrum Analyzers 188
Spectrum Monitor 572
Stereo Audio Monitors 572
Sweep System 572
Vectorscopes 542-545
Video Measurement Sets 539-541
Waveform Monitors 542-545

Terms and Methods of Sale 579

Test Leads 516

Test & Measurement Software 112, 119-120, 131, 139-141, 199, 23 239, 263, 367, 384, 385, 391, 539

Test Sets 312, 316
SDH/PDH 312, 316
SONET/DS3/DS1 312

Test Systems 367-388
Avionics 382
Cables/Connectors 386
Controller/Interface 383
Digital 379
Digitizers 372

Functional Index

General Information 368-369
Instruments 377
Mainframes 370
Software 384
Sources 378
Summary 388
Support/Service 385
Switching/Scanning 380
System Architecture 369

Thermometers, Digital 421

Time Domain Reflectometry (TDR) Systems
Metallic TDRs 305
Optical TDRs 298, 310, 346
Oscilloscope 94, 330
Probes, Low Frequency 461

Timing Analyzer 119

Tracking Generator For Spectrum Analyzers 184, 196, 198

Training/Seminars 588

Transient Limiter 244

Transmission Tester, SONET 320

Travel Accessories 528

V

Vectorscopes 542-545

Video Measurement Sets 539-541

Viewing Hoods 530

VITS/ITS Inserter 553

Voltage/Probe Reference Chart 448

VXI 367-388
Avionics 382
Cables/Connectors 386
Controller/Interface 383
Digital 379
Digitizers 372
General Information 368-369
Instruments 377
Mainframes 370
Software 384
Sources 378
Summary 388
Support/Service 385
Switching/Scanning 380
System Architecture 369

W

Wander Analyzer, SDH/SONET 324

Warranty, Repair, Upgrade Services 584

Waveform Analyzers 372

Waveform Digitizers 372

Waveform Monitors 544

Wavelength Meter, Optical 366

Wireless Communication Test Sets 268

Word Recognizer/Trigger Probes 515

Workstation, Carts 524

The Measurement Business

Tektronix is a portfolio of measurement, color printing, and video and networking businesses dedicated to applying technology excellence to customer challenges worldwide.

A leader in its markets through its 50-year history, Tektronix is universally recognized for quality products and technology innovations. The company is leveraging these strengths to help customers meet the business challenges of today and tomorrow, and to capture promising growth opportunities in areas such as digital video, office color printing, networked computing, and the convergence of audio, data, image and video signals within television, telephony and computer markets.

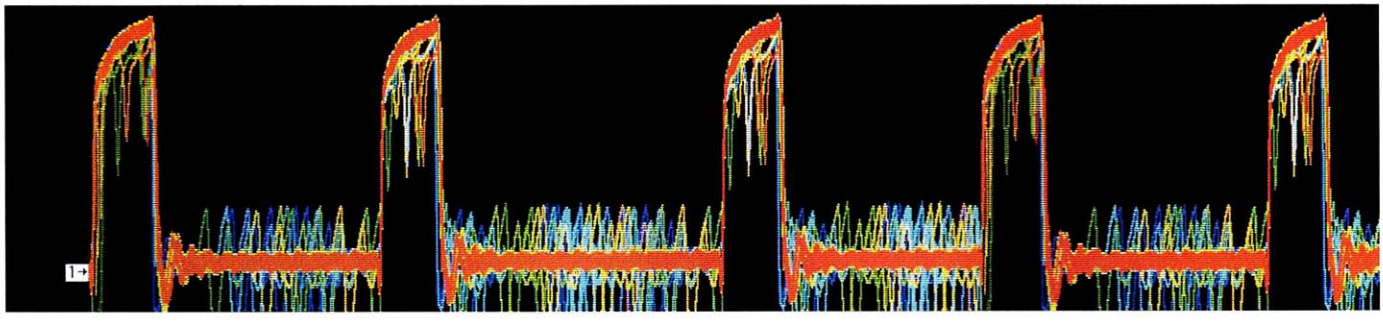
The Measurement Business Division is the industry leader in oscilloscopes, video test, digital design and fiber and metallic cable test. By leveraging strengths in signal acquisition, processing and display, the Measurement Business Division captures new growth opportunities created by the convergence of communications markets and technologies. In this arena, Tektronix can test all digital signals, as well as virtually every transmission path.

Within the test and measurement market, Tektronix is focusing on five distinct areas: Electronic Design Engineering, Manufacturing Test, Electronic Service, Communications Test, and TV Test. Below are the product offerings addressing these markets.

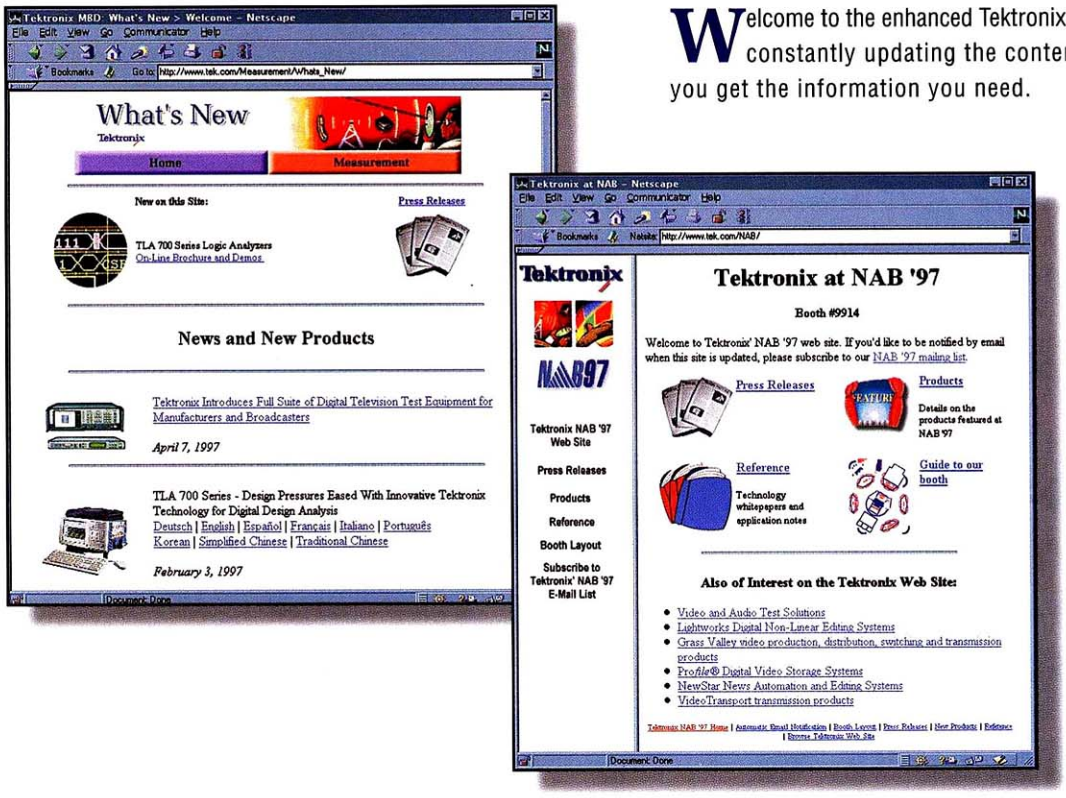
TEST AND MEASUREMENT MARKET/PRODUCTS

Electronic Design Engineering/ Manufacturing Test	Electronic Service	Communications Test	TV Test
• Oscilloscopes • Logic Analyzers • Spectrum Analyzers • Curve Tracers • Logic Sources • VXI Instrumentation	• Oscilloscopes • Power Supplies • Digital Multimeters • Function Generators • Counter • Digital Clamp Meter • Digital Thermometers	• OTDRs/TDRs • ISDN Testers • SDH/SONET Testers/Analyzers • Communications Signal Analyzer • Optical to Electrical Converters • SDH/SONET Reference Receivers • Bit Error Rate Tester	• Video Measurement Test Sets • MPEG Testers • Waveform, Audio and Digital Monitors • Vectorscopes • Generators • Inserters • Audio Measurement Testers • Switchers • Demodulators

Tektronix Products for every signal type



World Wide Web

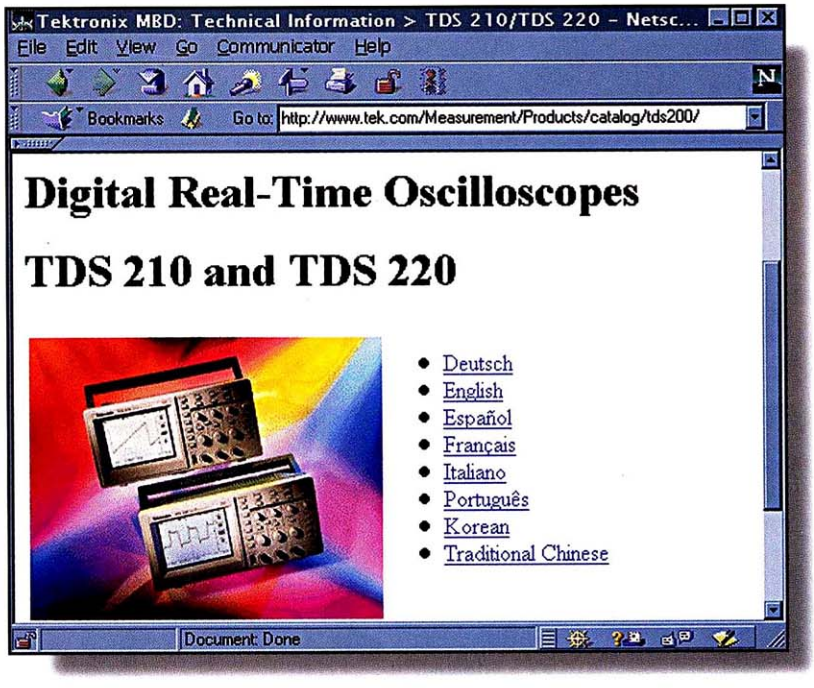


Welcome to the enhanced Tektronix web site. We are constantly updating the content and tools to help you get the information you need.

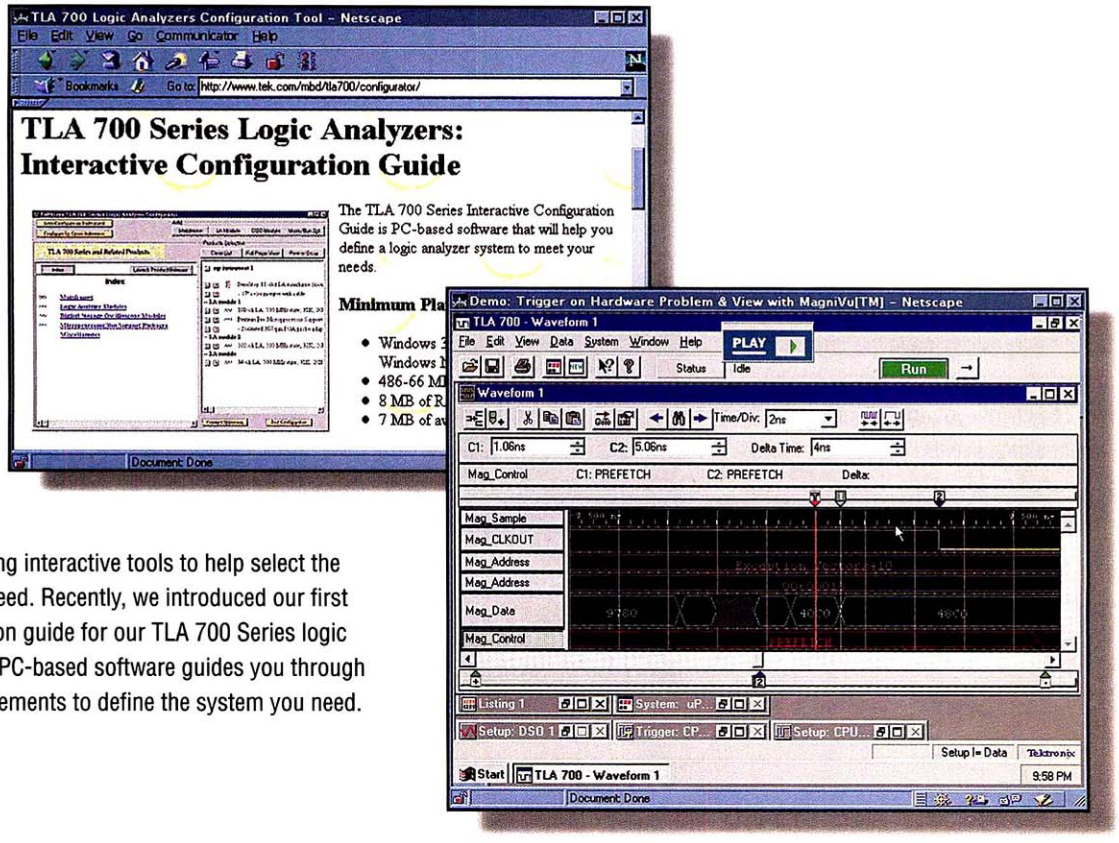
The Tektronix News Room is where you'll find current news releases, backgrounders, and product information. If you want information on a particular topic, please use our powerful News-search feature. And if you'd like to receive Tektronix news by e-mail, please click on "Subscribe". Like any other News Room, our information changes frequently, so please visit us often.

http://www.tek.com

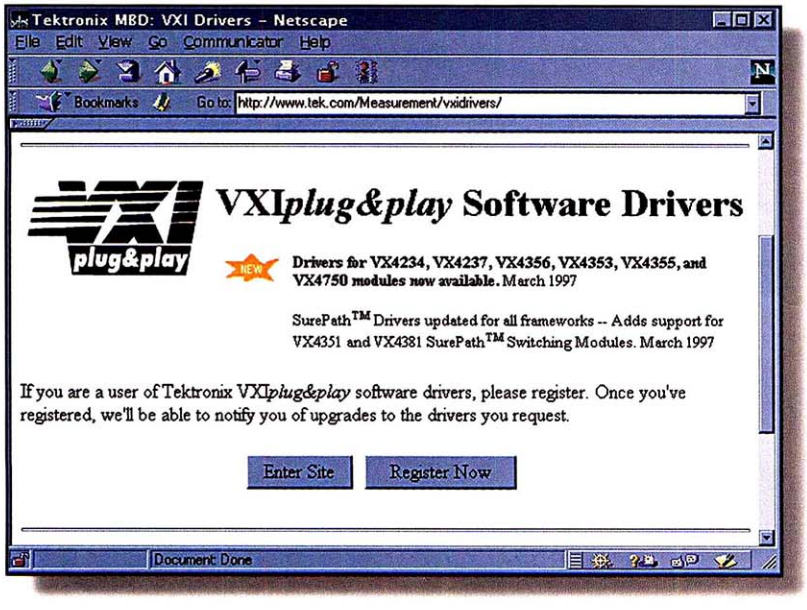
Doing business world-wide, we recognize the need to provide information in multiple languages. In the past year we've covered many new products in multiple languages.



World Wide Web



We are developing interactive tools to help select the product you need. Recently, we introduced our first interactive configuration guide for our TLA 700 Series logic analyzer system. This PC-based software guides you through identifying your requirements to define the system you need.



Download VXI software drivers at your convenience. Register with Tektronix, and we will notify you of upgrades to the drivers you request.

http://www.tek.com

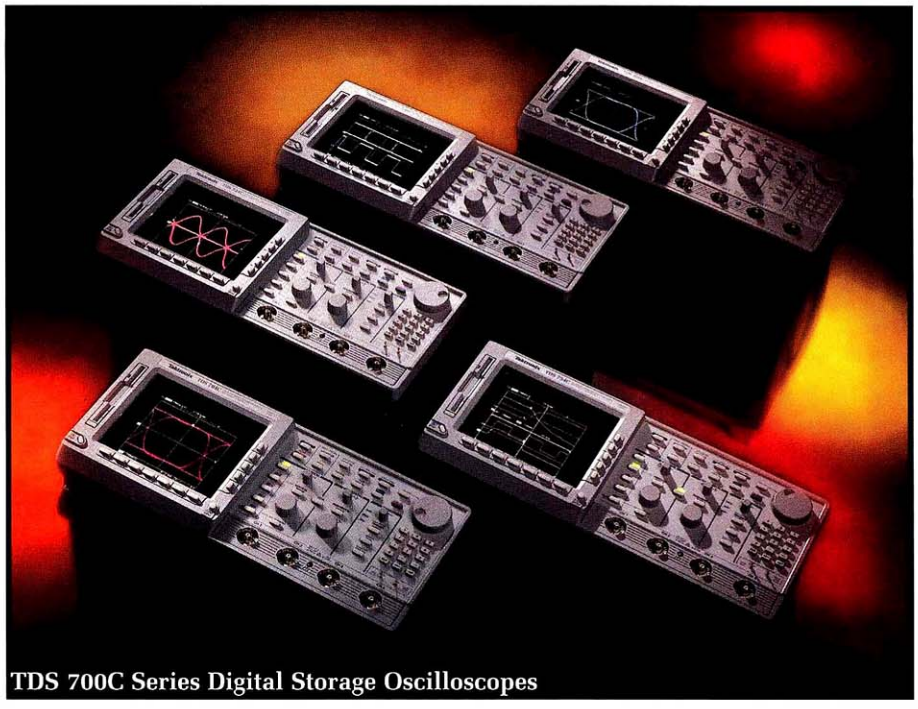
Oscilloscopes: New Products

TDS 700C

The TDS 500C/700C oscilloscopes are the latest in the TDS family of digitizing oscilloscopes designed to keep pace with current and evolving needs in advanced electronic design and debug. They are also powerful tools for communication design and R&D applications.

At over 400,000 waveforms per second, the TDS 500C and TDS 700C products with InstaVu™ Acquisition have the fastest waveform capture rate available on an oscilloscope. They allow you to instantly view even the rarest signal events.

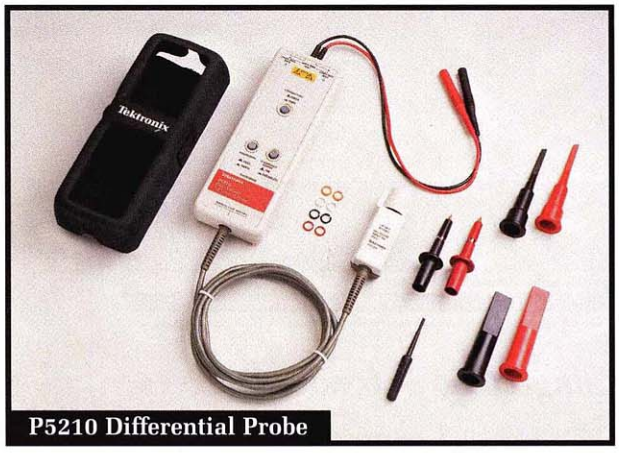
See pages 57–74



TDS 700C Series Digital Storage Oscilloscopes

The P5210 is a differential probe that has measurement capability for engineers and technicians who work with high floating voltages.

See page 500.



P5210 Differential Probe

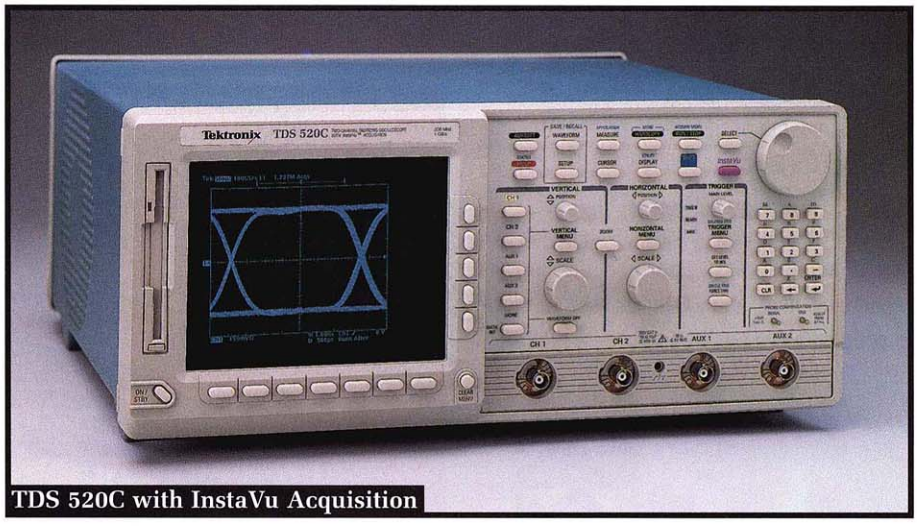
Oscilloscopes: New Products

TDS 500C Series

The new TDS 700C and TDS 500C Series set new standards for performance and feature-packed capability in an oscilloscope.

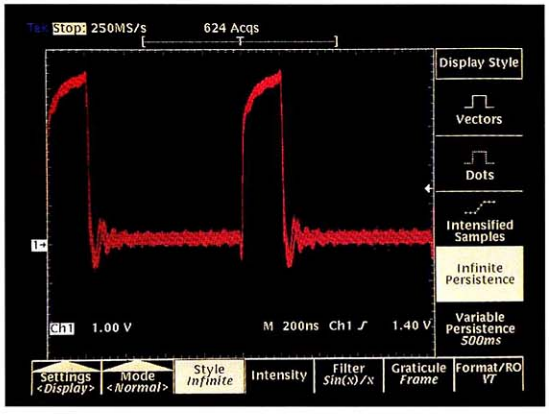
They are designed to keep pace with current and evolving needs in advanced electronic design and display applications. They also offer powerful new features such as mask testing, mask autoset and built-in optical reference receivers to tackle communication design and R & D applications.

See pages 57-74.

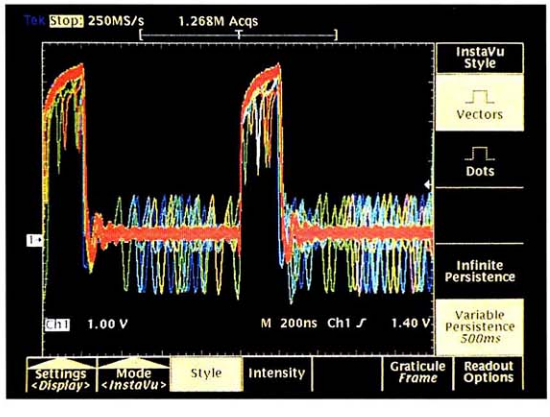


TDS 520C with InstaVu Acquisition

InstaVu Acquisition:
This waveform, captured in normal DSO mode, shows a well-behaved, repetitive digital waveform.



The same waveform, captured with InstaVu acquisition, uncovers detail in the signal which goes unnoticed by a common DSO.



Oscilloscopes: New Products

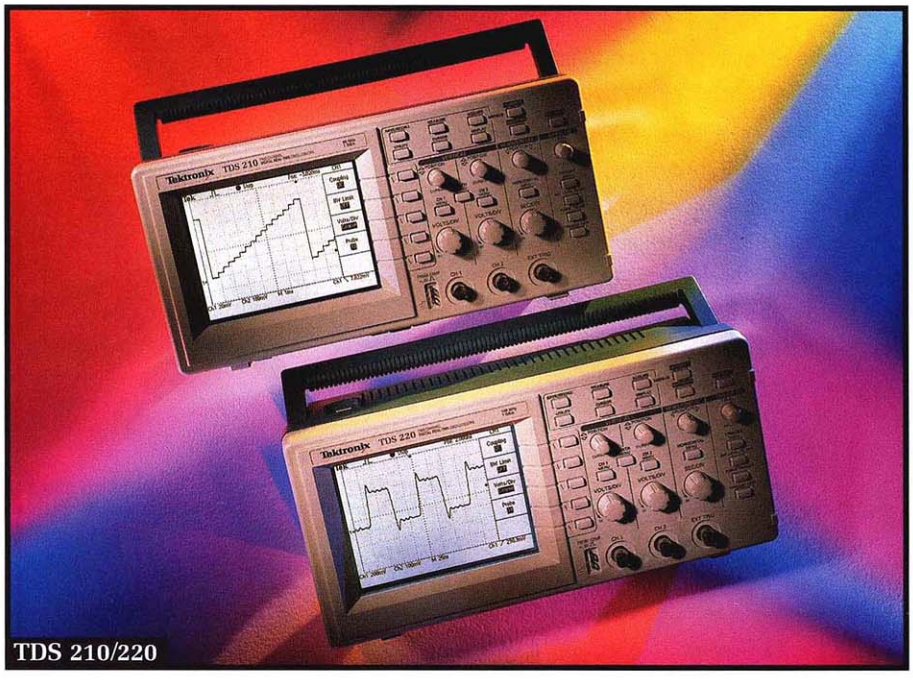
TDS 210/220 • TDS 300 Series

Tektronix, the worldwide leader in oscilloscope technology, offers breakthrough digital real-time advantages at low-cost analog oscilloscope prices. The 60 MHz TDS 210 and 100 MHz TDS 220 Digital Real-Time Oscilloscopes are an unbeatable value for performance, reliability, and affordability. Fast, error free measurements, low cost, and a familiar user interface encourage analog users to move to digital oscilloscopes.

See Page 87.

ELECTRONIC PRODUCTS
1996 PRODUCT OF THE YEAR AWARD

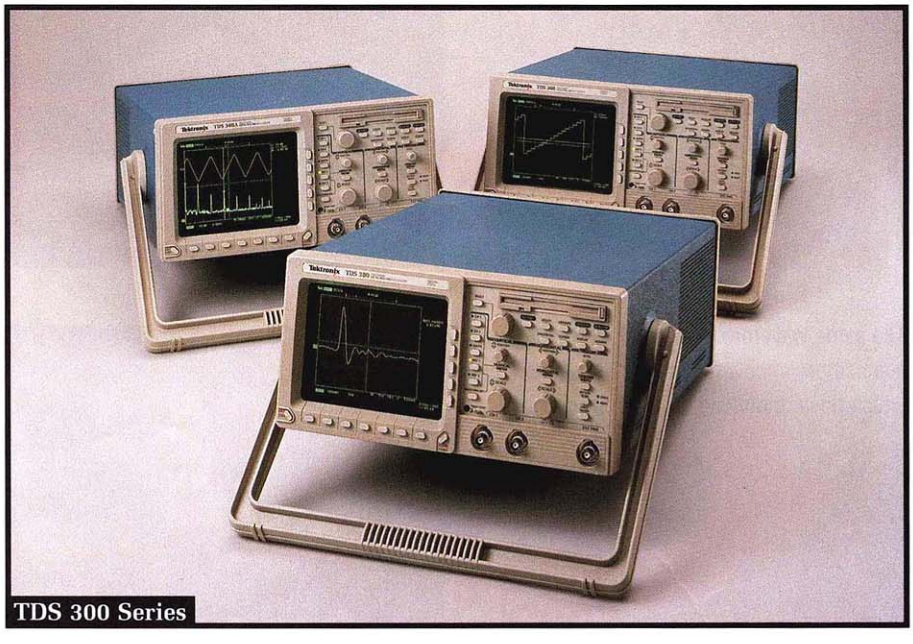
TEST & MEASUREMENT WORLD
BEST IN TEST
1997
AWARD WINNER



TDS 210/220

The TDS 300 series Digital Real-Time Oscilloscopes set a new price/performance standard. Each input channel is independently over-sampled to acquire signals over its entire bandwidth, even when measuring transient or single shot events at the fastest sweep speed. Their intuitive interface combines dedicated knobs with menu-driven functions.

See Page 83.


TDS 300 Series

Oscilloscopes: New Products

THS 700A Series

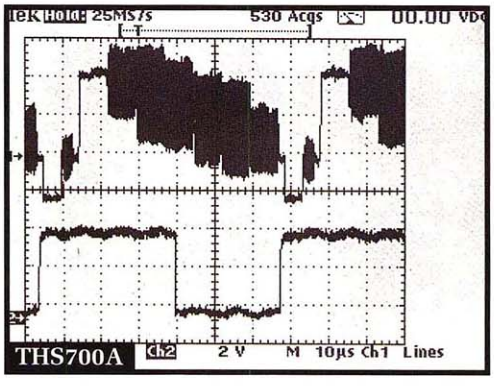
The Award-winning THS700A Series now Includes a 200 MHz version – The THS730A is the Highest Performance Handheld Scope in the Market. The new THS720P TekScope with isolated Channel™ architecture is ideal for electric/power electronics applications. The TekScope® THS700A Series Scope/DMM combines a full-featured Digital Real-Time™ oscilloscope with a True RMS digital multimeter in rugged, battery-operated instruments. The high-resolution, backlit display and pop-up menus make it easy for users to take full advantage of the instrument's many features.

See Pages 90, 92.

THS 700A Series DRT Oscilloscope

EDN INNOVATION '95 — WINNER

TEST & MEASUREMENT WORLD BEST IN TEST 1996 TEST PRODUCT OF THE YEAR

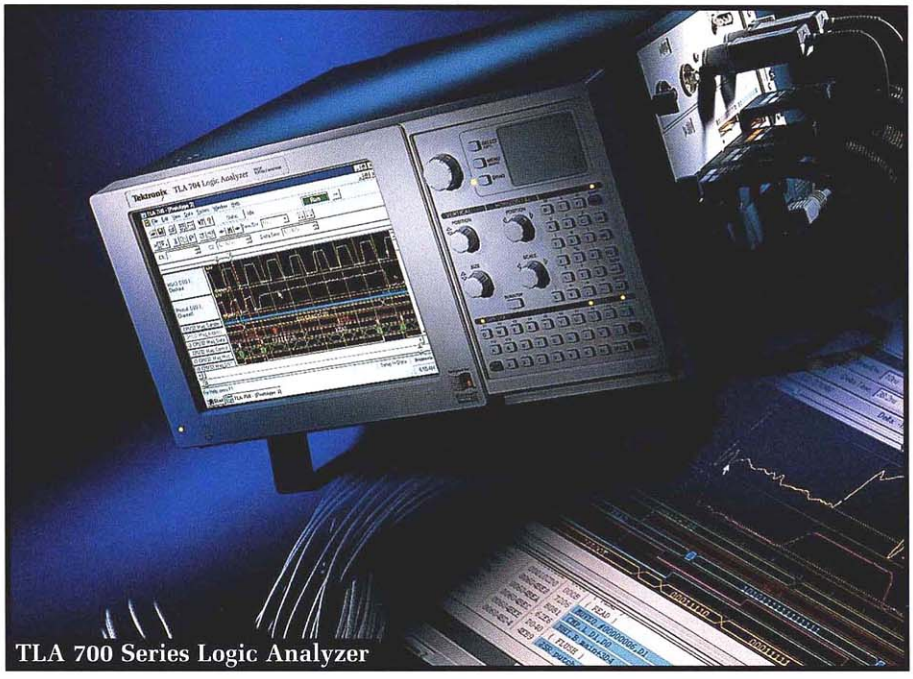


Logic Analyzers: New Products

TLA 700 Series

The TLA 700 Series is a new family of instruments developed specifically to address the fast-changing needs of today's digital design engineers. These products bring new technology to bear on the time and design pressures faced by digital system designers. The family consists of portable and benchtop mainframes, logic analyzer modules, DSO modules, and a full line of complementary support products for popular microprocessors and buses.

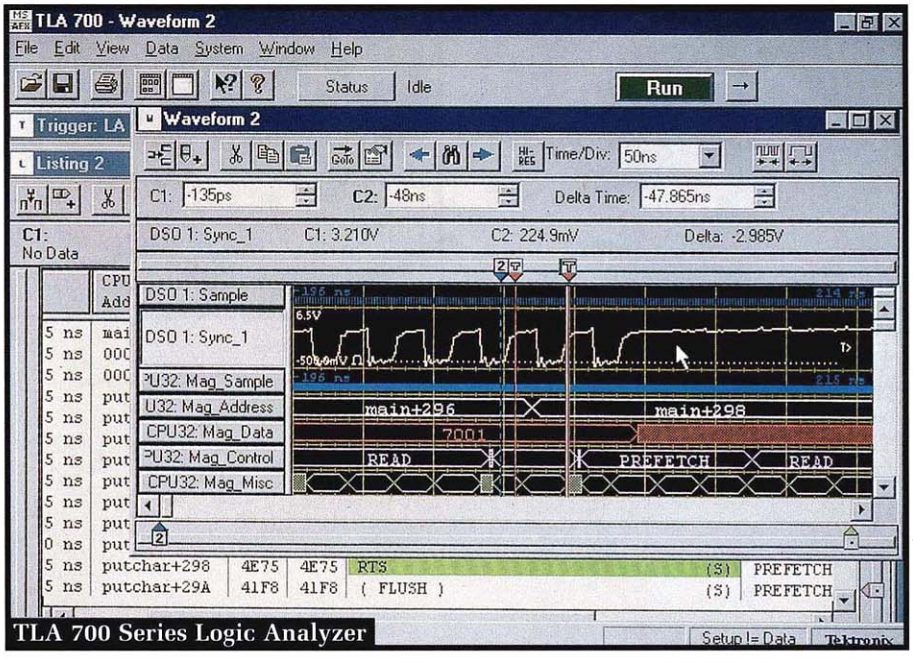
See page 120.



TLA 700 Series Logic Analyzer

At the heart of all of the TLA 700 Series logic analyzer modules is a breakthrough called MagniVu™ acquisition technology. MagniVu acquisition technology is a super-high-speed sampling architecture that dramatically changes the way logic analyzers work and what functionality they offer. All incoming data is over-sampled at a 2 GHz rate, regardless of how the logic analyzer is being used. The over-sampled data is then processed in real-time to perform timing acquisition, state acquisition, and triggering without missing the slightest piece of crucial timing information on any channel.

See page 120.



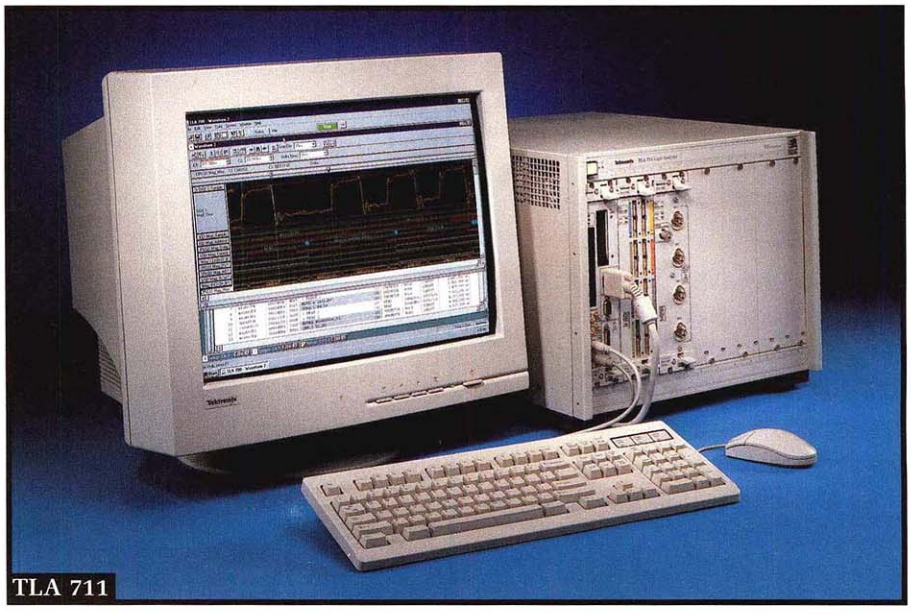
TLA 700 Series Logic Analyzer

Logic Analyzers: New Products

TLA700 Series

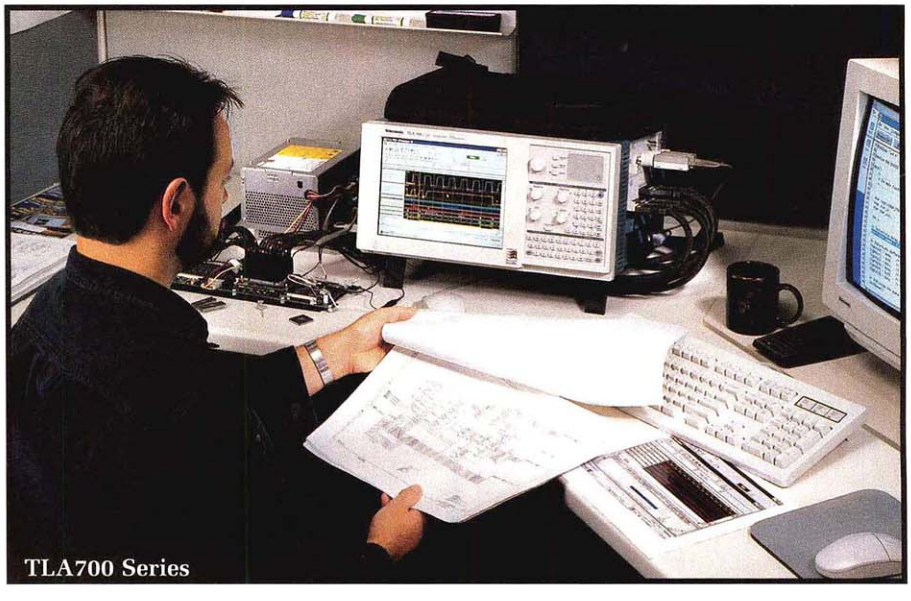
Both the portable TLA 704 and the benchtop TLA 711 combine impressive performance and a modern graphical user interface to simplify debugging complex system problems and enable engineering teams to meet or beat their development schedules.

See page 120.



TLA 711

Designed for Microsoft Windows 95



TLA700 Series

Telecommunications: New Products

TOP 220 • AFTDS • P6700 Series

The AFTDS Differential Signal Adapter and the AMT75 75 Ω Adapter provide an effective means for 50 Ω terminated instruments to connect to and analyze differential and high speed electrical communication signals as well as video signals.

See page 334.

The P6700 Series O/E converters are ideal for optical source characterization in the development, manufacture, or service of optical communication systems and devices.

The P6246/47 high bandwidth differential probes can be used for pulse shape or cross-talk compliance testing of high speed communication signals.

See page 336.

AFTDS, AMT75, P6700 Series

The Tektronix TOP220 handheld Optical Power Meter covers the full range of optical applications. This instrument is quality engineered for field and lab application requiring a high performance, cost-effective, compact, and rugged optical power meter. The TOP200 uses the Snap-On Connector (SOC) interface.

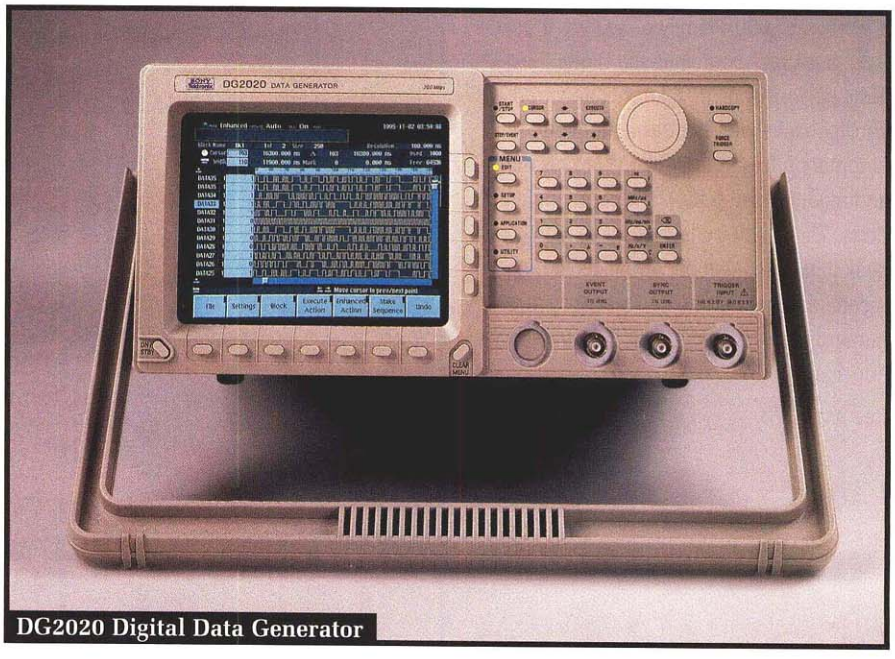
See page 296.

Logic Sources: New Products

DG2020

The Tektronix DG2020 digital data generator combines the high performance needed to test the latest technology devices with unprecedented ease of digital pattern creation and modification. The DG2020 is used to replicate valid, marginal and erroneous digital conditions that a design could encounter. What separates the DG2020 from other digital pattern generators is its superior user interface combined with high performance. Everything need to load, modify, and output vectors is built-in. Capabilities such as advanced sequencing (looping), built-in encoding schemes, and flexible editors make the DG2020 a powerful addition to your suite of test instruments.

See page 404.



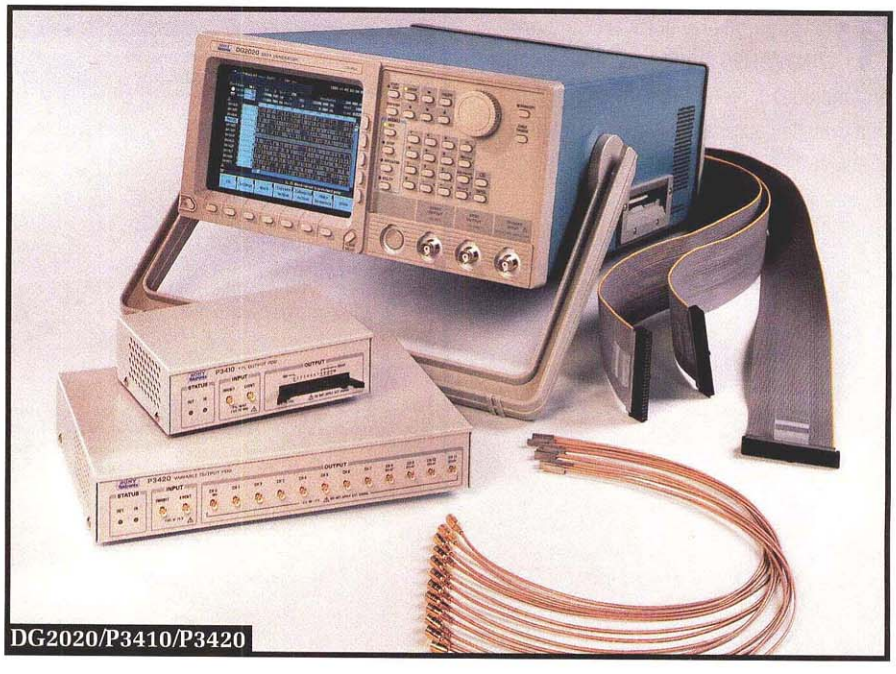
DG2020 Digital Data Generator

The DG2020 offers the data rate up to 200 Mbps, 64 K data words length, up to 36 output channels in 12-Channel increments and 100 ps timing delay control up to 20 ns function in the portable main frame.

P3410 output pod provides TTL level signal from a grouped pin-header connector.

P3420 variable output pod provides 500 mV to 9 Vp-p (–3 V to 7 V), 100 mV increment that cover ECL, TTL CMOS logic level. Output connections consist of independent SMB connectors for each channel. The P3420 is capable of >30 mA of current sourcing, enough for your most demanding applications.

See page 404.



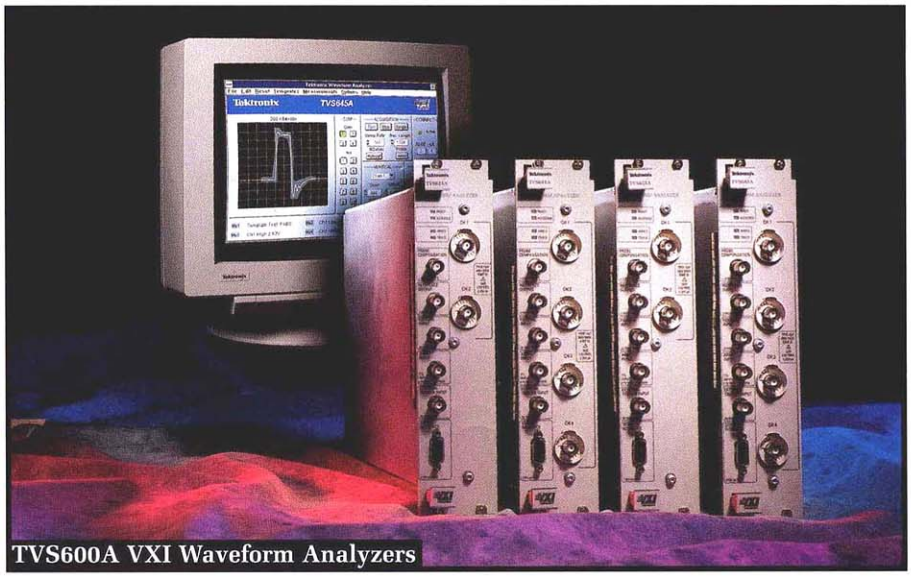
DG2020/P3410/P3420

VXI: New Products

TVS600A

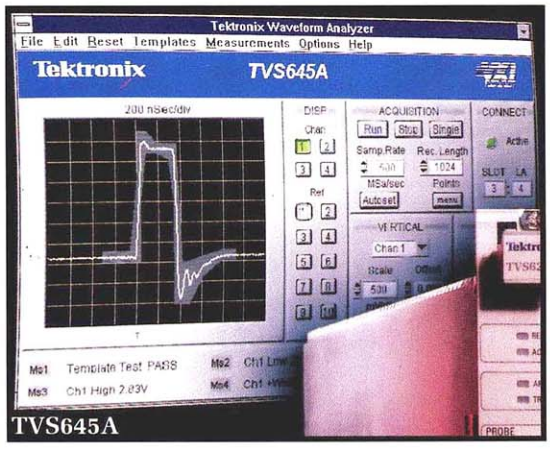
The TVS600A family of VXI waveform analyzers combines the Digital Real-Time performance of Tektronix powerful TDS oscilloscopes with the throughput and automation features required for research and manufacturing functional test applications. The new A-series products include peak detect acquisition, template testing, measurement limit testing, statistics and numerous extensions to the built-in calculation system.

See page 373.



TVS600A VXI Waveform Analyzers

The VXIplug&play software supports WIN, WIN95 and WINNT frameworks and includes a hierarchical instrument driver that provides access to all instrument features.



TVS645A

VXI: New Products

VX4351 • VX4381 • VX4101

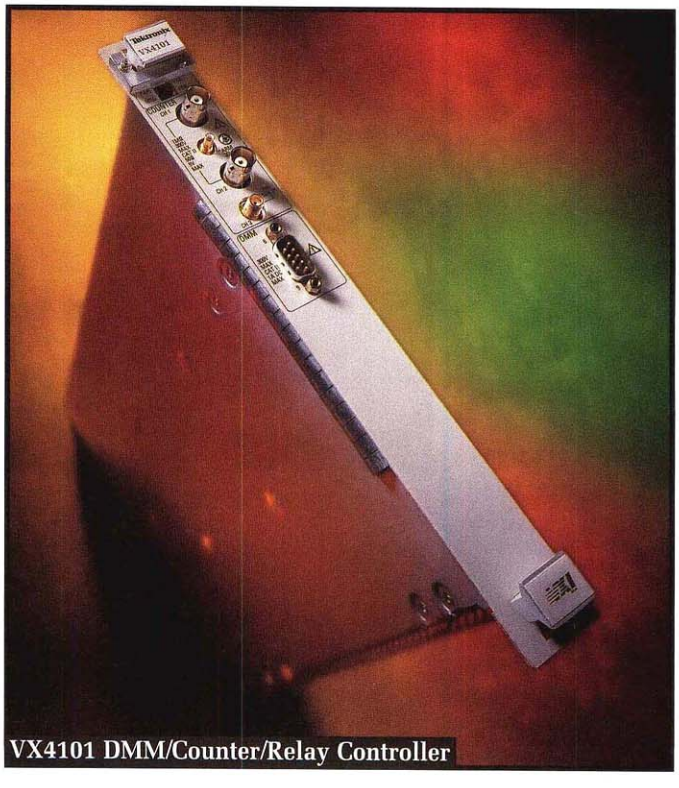
Two new high-current VXI switching modules – the VX4351 and VX4381 – extend the power handling capability of the Tektronix SurePath™ routing and switching technology from 2 to 10 Amps. The VX4351 and VX4381 allow automotive and defense/aerospace engineers to easily and accurately switch high currents without the need for externally mounted relays. Both modules feature interchangeable socketed relays that create a fully integrated signal routing solution and improve ease of use.

See page 380.

VX4351/VX4381

The VX4101 DMM/Counter combines the core test instruments required by manufacturing functional test applications into a single VXI slot. The DMM is often the workhorse measurement tool used to check voltage, current, or resistance. The counter is needed for time and frequency measurements. Switching is always an important test system element since signals must be routed between the unit under test and the test equipment. The VX4101 is the first test instrument to combine all of this functionality into one small, complete package:

See page 371.



VX4101 DMM/Counter/Relay Controller

Handheld Test Instruments: New Products

DMM 912 • DMM 914 • DMM 916 • DTM 900 • DTM 920 • DCM 910

The DMM 910 series handheld digital multimeters from Tektronix are compact, battery-powered units with high measurement resolution and accuracy. Built-in safety features provide a high level of operator protection.

The three models share a common physical and operating format but vary in the features and accuracy. The DMM 912 provides industry standard performance while the DMM 916 provides unequaled accuracy and measurement features.

See Page 416.

DMM 912/914/916 Handheld Digital Multimeters

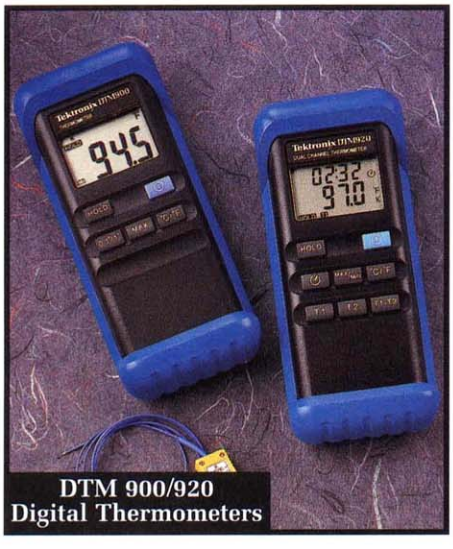
The DTM 900 series digital thermometers from Tektronix are compact, battery-powered units. The DTM 900 offers basic, easy-to-use temperature measurement.

The DTM 920 offers two-channel and differential temperature measurements over a wide temperature range with better accuracy.

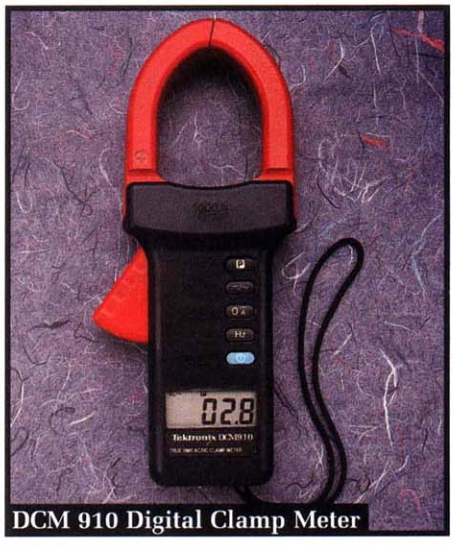
See Page 421.

The DCM 910 Digital Clamp Meter is a battery-powered current meter from Tektronix. The DCM 910 enables users to measure true RMS AC and DC currents without breaking the circuit under test. The DCM 910 also provides frequency measurement capability for quick characterization of AC signals.

See Page 422.



DTM 900/920 Digital Thermometers



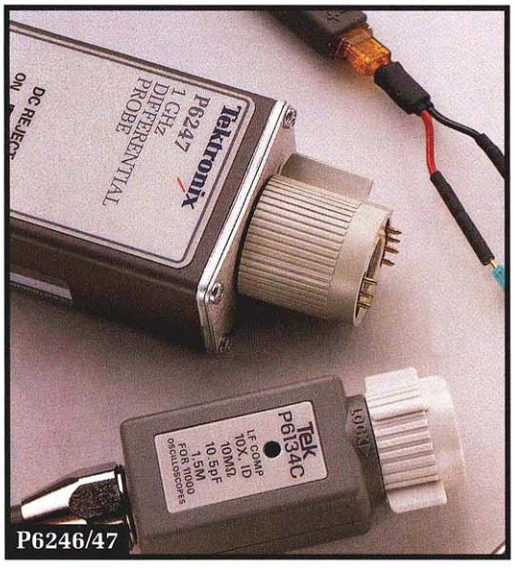
DCM 910 Digital Clamp Meter

Accessories: New Products

P6246 • P6247 • SMK4

Tektronix' offering of SMT probing and inter-connect device meets the demanding requirements of decreased device size and tighter lead spacing. The P6246 and P6247 enable users to make time domain or frequency domain measurements on high bandwidth signals commonly found in disk drive, digital IC design, and communication applications. The small probe head geometry and assorted probe tip accessories allow these probes to easily accommodate manual probing of surface mount devices while maintaining high CMRR.

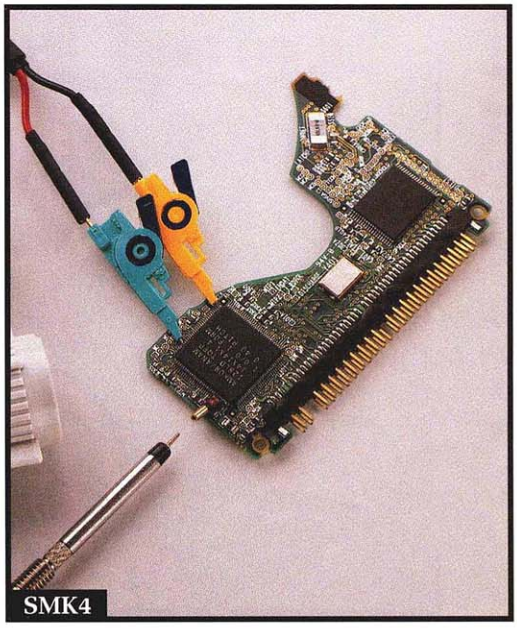
See Pages 336, 496.



P6246/47

The SMK4 is an interface device which can attach to fine-pitch IC leads similar to the SMG50. The difference between the SMK4 and the SMG50 is the size. The SMK4 can be used to attach to PQFP packages up to a pitch of 0.5 mm which is five times smaller than the SMG50.

See Page 474.

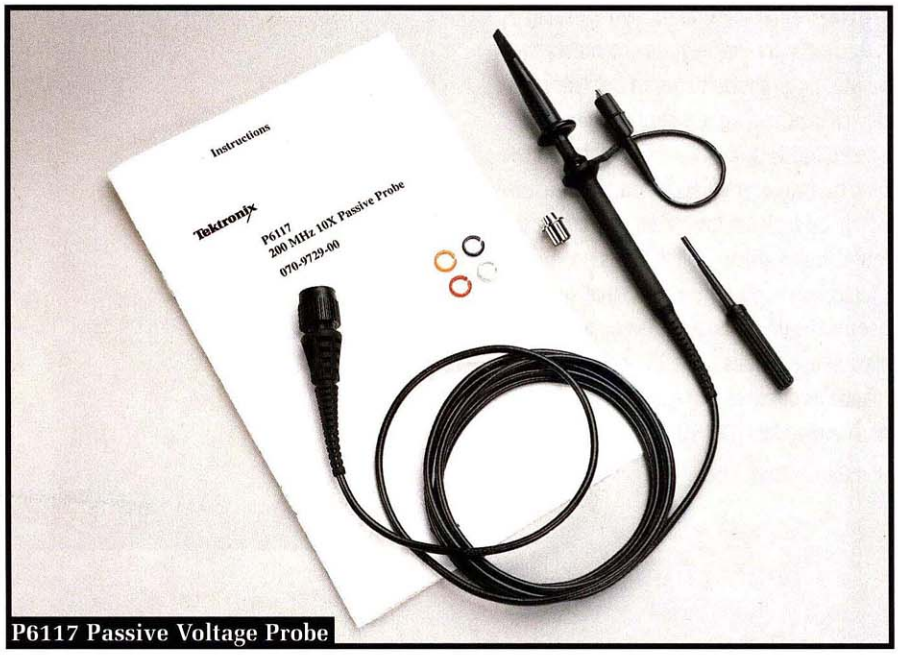

SMK4

Accessories: New Products

P6112 • P6114B • P6117 • P6138A

The P61XX family of probes are designed to complement Tektronix' family of portable DSO and ART instruments. The core of each probe's performance is supplied by a Tektronix HYBRID/SMT device. Tektronix' instrumentation experience provides an extra margin of quality and reliability to these probes that is not commonly available to probe manufacturers. These probes have been designed and tested to support the overall system performance and measurement quality that Tektronix oscilloscopes guarantee.

See Page 464.

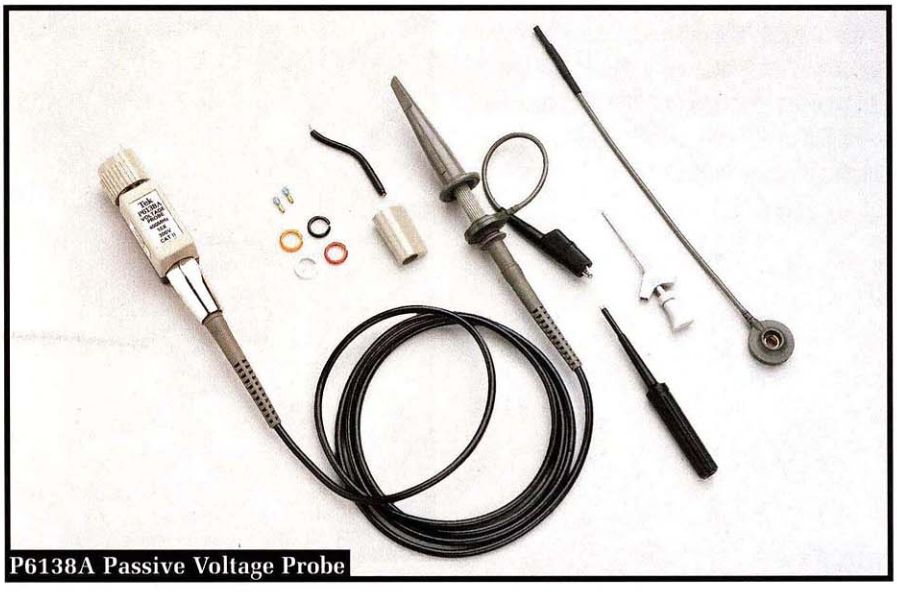


P6117 Passive Voltage Probe

The P6138A oscilloscope probe sets the standard for high performance passive voltage probes. Continued growth of the family paces Tektronix' new series of high performance bench top oscilloscopes such as the TDS400A Series.

P6138A probes feature modular construction, HYBRID/SMT circuitry, a smaller probe head/cable assembly than traditional passive probes, 10X attenuation, readout encoding, and a full complement of attachment accessories. Smaller probe tips and lightweight cable assemblies allow easy negotiation of dense circuitry or tight spaces.

See Page 470.



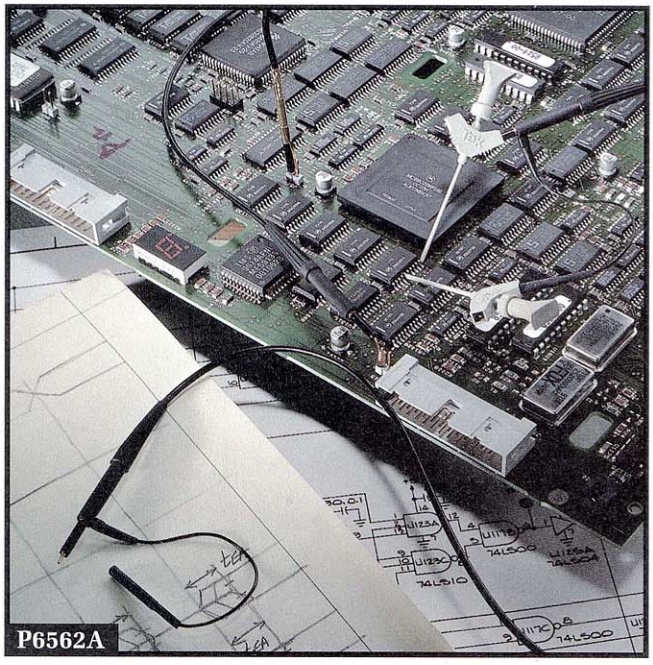
P6138A Passive Voltage Probe

Accessories: New Products

P6561A • P6562A • P6563A • P5210

The P6561A, P6562A, and P6563A are scaled for surface mounted IC packages. Their low-mass probe body is only 1.5 inches long and 100 mils wide. These probes provide solutions for the most popular EIAJ and JEDEC surface mount packages.

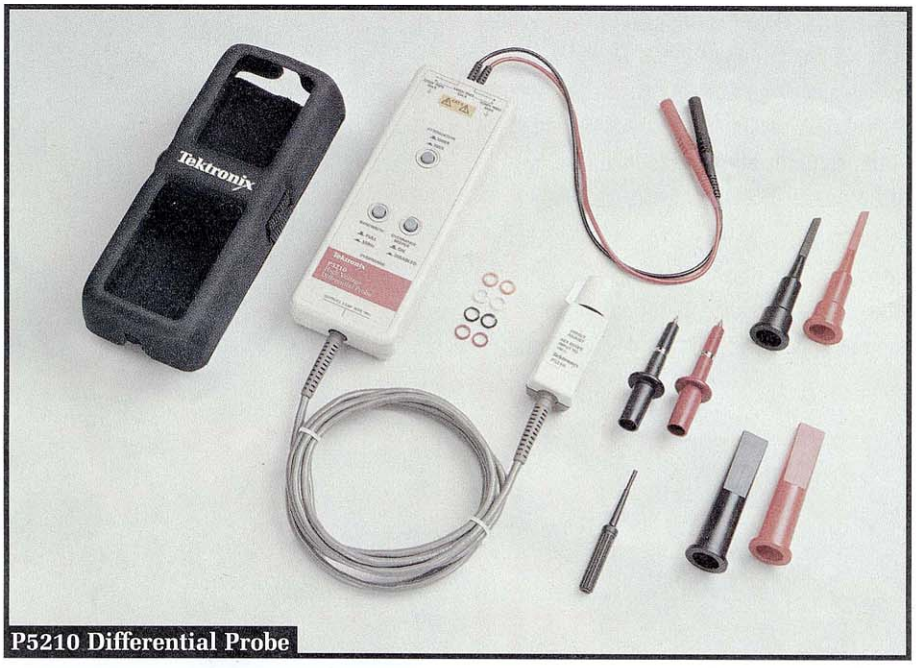
See Page 472.



P6562A

The P5210 is a differential probe that has measurement capability for engineers and technicians who work with high floating voltages. This 5,600 V (DC + peak AC) differential probe allows users to measure floating voltages in their systems and circuits safely and is the highest rated differential probe on the market. When used with Tektronix oscilloscopes with TekPROBE® interface, the P5210 is powered directly by the oscilloscope and no battery or AC adapter is required.

See Page 500.



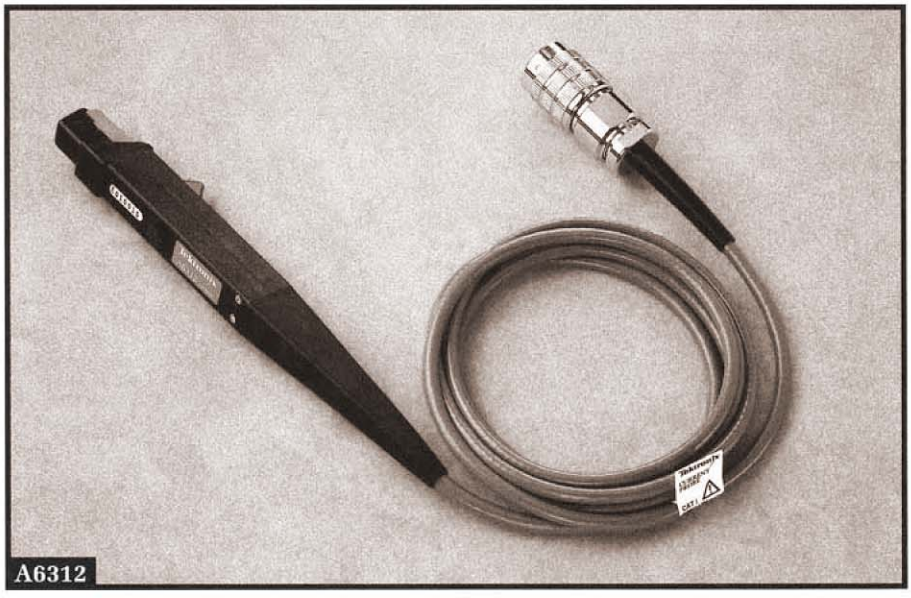
P5210 Differential Probe

Accessories: New Products

A6312 • TCP 202

The A6312 covers frequencies from DC to 100 MHz while the A6302 covers DC to 50 MHz. Both clip onto conductors up to 3.81 mm (0.15 in.) and measure continuous currents up to 20 A and peak currents up to 50 A as long as they do not exceed the amp*second product of 100 A*µs. The larger A6303 measures higher amplitude, lower frequency currents.

See Page 511.



A6312

The TCP 202 DC Coupled Current Probe when combined with a Tektronix TDS oscilloscope, the TCP 202 enables users to make direct readout DC and AC current measurements, resulting in accurate displayed and recorded measurements.

The TCP 202 is a general-purpose probe for displaying and measuring current in electronic circuits. It's ideal for power supply and motor drive design, and for device testing.

See Page 507.

TCP 202 Current Probe

Television: New Products

MTG200 • MTD200 • VM 700T

The Tektronix MTG200 MPEG Test Generator produces continuous, seamless transport streams in compliance with the MPEG2 standard. With this unique capability, the MTG200 is the perfect fit for high-volume manufacturing lines where continuous, error-free transport streams are required for maximum throughput.

See Page 535.

MTG200

The Tektronix MTD200 MPEG Test Decoder is a low-cost, real-time analyzer for conformance checking of MPEG2 transport streams. Featuring a built-in decoder for audio and video signals, the MTD200 is optimized for operational monitoring applications. It has one parallel and two serial inputs as stipulated by Digital Video Broadcast (DVB) specification A010. All menus for operation of the decoder and measurement values are displayed on a front-panel two-line LCD. These menus and data can also be output to an external video monitor.

See Page 537.

MTD200

The VM 700T, a replacement product that will maintain the heritage of the company's flagship video test instrument, the VM 700A. The highly automated video measurement set will provide significantly enhanced measurement speed performance and additional high-value features.

See Page 539.

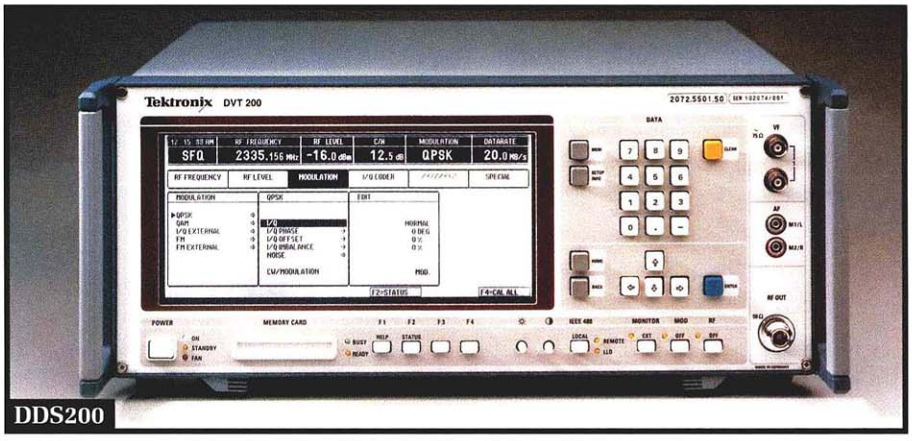
VM 700T

Television: New Products

DDS200 • DVT200

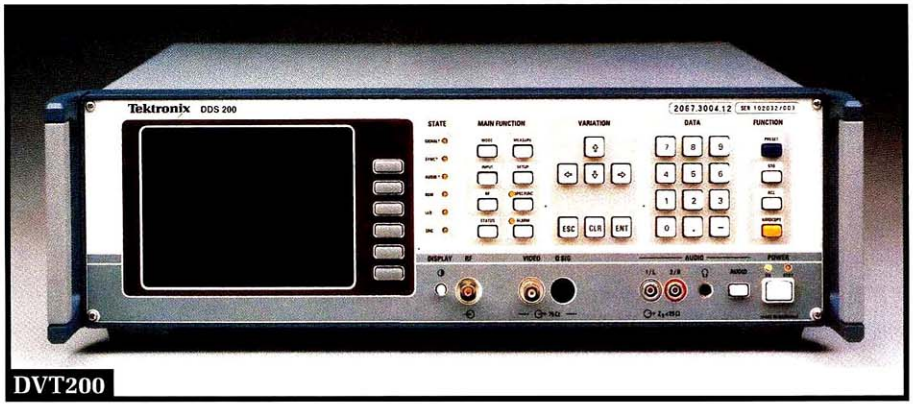
The DDS200 Digital Demodulation System is an essential tool for evaluating DVB-C signals and modulation equipment. The DDS200 is both a demodulator and a modulation analyzer.

See page 570.



The DVT200 Digital Video Transmitter is the ideal tool for evaluating the performance of DVB-compatible receivers. Its 1 MHz to 3.3 GHz frequency range and error-protected QPSK or QAM modulated signals allow testing of both DVB-C cable receivers and DVB-S satellite receivers with one product. The DVT200 provides both I/Q and MPEG2 inputs for maximum flexibility.

See page 568.



Television: New Products

TG2000 • WFM 601A • WFM 601E

The TG2000 is a multiformat, analog and digital, precision signal generation platform. Designed for the most demanding test applications, the TG2000 provides reference quality test signals, stressing functions in both the analog and digital domain, and the flexibility to address user-defined testing requirements. Comprehensive test signal libraries are supplied in all formats and are supplemented by a Windows-based test signal development program. The modular architecture, RAM based test signal generators, and programmable system clocks ensure the TG2000 will meet future needs as well as today's requirements.

See page 546.

TG 2000

The WFM 601A/E Serial Component Monitors provide signal monitoring features for the 270 MB serial component operating environment, including Tektronix Diamond, Lightning, Bowtie, and Arrowhead displays. The WFM 601E adds Eye Pattern display, to its feature set.

See page 544.

Tektronix Phaser® Color Printers

High-quality Color for any Application

The Leader in Workgroup Color Printing

For 15 years, Tektronix has set the standards for network color printing. No other manufacturer can match our comprehensive product line or our consistent award-winning performance. From solid ink to color laser, from record-setting speeds to crisp 1200 dpi resolution – whatever your requirements – you can be sure there's a Tektronix color printer that's designed just for your application. No wonder, at over $500 million in color printing revenue, Tektronix sells more workgroup color printers than anyone.

Color Printers Engineered for Networks

Tektronix Phaser color printers are designed from the ground up to tackle the demands of workgroup applications. It's more than simply convenience. It's advantages like high-speed image processing, easy networking, cross-platform print support, volume printing capacities, and color copier options – to name a few. They all add up to increased productivity and efficiency. When your network is ready to plug and play in full color, see your authorized Tektronix dealer.

Designed for Microsoft Windows 95

Adobe PostScript

Yes NetWare

energy

PANTONE CALIBRATED™

Mac OS

Call 1-800-835-6100 for your nearest Tektronix color printer dealer.

See Tektronix on the World Wide Web: http://www.tek.com/Color_Printers/

Tektronix' comprehensive product line provides high-quality color printing for any application.

PHASER® 140 COLOR PRINTER

- Affordable PostScript Color Printing
- Lowest Cost Phaser Quality
- Shareable with PCs, Macs, and workstations
- Adobe PostScript

PHASER® 300X COLOR PRINTER

- World's Most Versatile Color Printer
- Tabloid-size for Graphics and Engineering Users
- Superb Color on Any Paper
- Flexible Sizes up to 12 in. x 18 in.

PHASER® 350 LASER-CLASS COLOR PRINTER

- Takes the Cost Out of Color
- 6 ppm Color Printer for the Office
- Superb Color Quality
- Best Price/Performance
- Office Friendly

Tektronix Phaser® Color Printers

High-quality Color for any Application

PRINTER SUPPORT
Tektronix PhaserLink™ software provides an unprecedented level of print support for end users and systems administrators. With PhaserLink, you can check printer status, set configuration, and access on-line documentation – right from your desktop. Platform independent, it works with standard world wide web browsers. Available on select models.

COLOR MATCHING
For point-and-click simplicity, all Tektronix color printers feature TekColor™ Dynamic Correction color control. It's easy to use and provides accurate color simulations of printing presses and other common color standards. For the most precise color matching, PhaserMatch™ software, available on specialty printers, allows you to create custom color profiles to your exact specifications.

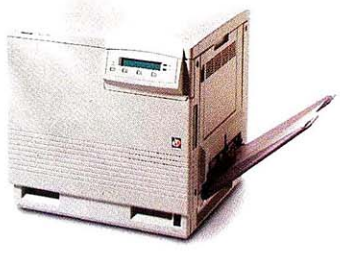
CUSTOMER SUPPORT
All Tektronix color printer customers are supported by TekColor Care℠. At your service are telephone technical support, an award-winning world wide web site, an automated 24-hour fax reference library, electronic bulletin board, a newsletter about color printing, and a one-year warranty.

Call 1-800-835-6100 for your nearest Tektronix color printer dealer.

See Tektronix on the World Wide Web: http://www.tek.com/Color_Printers/

PHASER® 450 COLOR PRINTER
- Letter-size Photographic Quality
- 8.5 in. x 11 in. Bleeds
- Fast Printing
- Color Matching Made Easy
- Wide Variety of Printing Media

PHASER® 480X COLOR PRINTER
- Tabloid Photographic Quality
- Tabloid Bleed Color Comps & Proofs
- Color Matching and Customizable Profiles
- Technical/Scientific Applications



PHASER® 550 COLOR LASER PRINTER
- High-performance Color Laser
- 5 ppm Color
- 14 ppm Monochrome
- High Capacity for Large Volume Printing
- High Definition Color, up to 1200 x 1200 dpi
- Letter and Legal Size

PHASER® 600 COLOR PRINTER
- Tektronix Quality in Poster-size
- Fast Printing
- Color Accuracy
- Optimum Media Flexibility
- Remarkably Easy to Use

PHASER COPYSTATION
The Phaser Copystation provides a convenient way to make color copies of any original on your Phaser color printer. Available on select models.

Oscilloscopes

From the highest performance to the most cost-effective solution, Tektronix offers a broad range of test and measurement instrumentation. Tektronix oscilloscopes provide the best connection to your device-under-test, the most accurate signal acquisitions, the sharpest waveform displays, and the most comprehensive on-board waveform measurements available.

It takes a broad range of oscilloscope products to satisfy the spectrum of measurement applications throughout the world today, and Tektronix delivers the product line breadth sought by customers worldwide.

CONTENTS

OSCILLOSCOPE REFERENCE

Selecting an Oscilloscope....50
Selection Guide....50
Data Management....52
Technology....53
New Products....54
Accessories....55

TDS SERIES

TDS Reference....57
TDS Selection Guide....58
TDS 820 Digitizing Oscilloscope....64
InstaVu™ Acquisition Mode....67
TDS 500C/TDS 700 InstaVu Acquisition Oscilloscopes....68
TDS 510A Digitizing Oscilloscope....77
TDS 600 Series Digital Real-Time™ Oscilloscopes....74
TDS 400 Series Personal Lab Oscilloscopes....79
Personal LabScope Solutions....82
TDS 300 Series Digital Real-Time™ Oscilloscopes....83
TDS 200 Series Digital Real-Time™ Oscilloscopes....87

HAND HELD BATTERY OPERATED OSCILLOSCOPE/DMM

THS 700 Series....90

11800 SERIES DIGITAL SAMPLING OSCILLOSCOPES

11800 Series....95, 97
CSA Series....95, 330
Sampling Heads....102

LOGIC SCOPE

TLS 216....115

VXI OSCILLOSCOPE CARDS

TVS 600A Series....372

ACCESSORIES

Probes....438
SMD Adapters....474
Probe and Instrument Accessories....480
Printer....522
Instrumentation Carts....524

ELECTRONIC LAB NOTEBOOK SOFTWARE

TTIP....66
WaveStar....112
LabWindows/CVI....384
LabView PC Windows....384
Wavewriter....391

Oscilloscope Reference

Tektronix Quality and Reliability

Tektronix' oscilloscope quality and reliability are unmatched. Designs are thoroughly scrutinized and tested to ensure compliance with all applicable safety and environmental standards. Calibration is traceable to national standards and conforms to military procedures. Our service network is designed to help you keep your oscilloscope calibrated and working with fast turnaround.

Selecting an Oscilloscope

The first step in selecting an oscilloscope is to know what you're expecting to see with the scope. In other words, what are the typical characteristics of the signals you need to capture and view. Are your signals repetitive or single shot? What is the bandwidth and/or risetime of the signals or transients you need to capture? On what signal characteristics will you need to trigger – runts, pulse widths, slew rates, glitches? How many signals do you need to display simultaneously? The answers to these questions will determine the type of scope you need. Which brings us to the actual spec sheet considerations: bandwidth, sample rate, waveform capture rate, record length, triggering, and other capabilities.

THE "5 TIMES" RULE FOR BANDWIDTH

A DSO's bandwidth specification gives you an idea of the instrument's ability to handle high-frequency signals. If the bandwidth of your scope is inadequate, high frequency information will be filtered out and critical timing information may be displayed inaccurately. It's important to remember that a scope's bandwidth is derived from how well it reproduces a sine wave. If you're dealing with high speed digital electronics, you may never see a sine wave. A good rule of thumb for determining the bandwidth you need is to use the "5 times rule": to figure out the bandwidth of the scope you need, multiply the highest frequency component of the signals you want to examine by five. This will typically give you better than 2% accuracy in your measurements.

In some applications you may not know the bandwidth of the signal of interest, but you will know the risetime. The frequency response of most scopes is designed so that a constant allows you to relate the bandwidth and risetime of the instrument using the equation:

–3 dB Bandwidth x Risetime = K

where: –3 dB Bandwidth is in Hertz, Risetime is the 10% to 90% risetime in seconds and K is a constant that depends on the oscilloscope input filter type.

As a general rule of thumb, when selecting an oscilloscope you can assume that the bandwidth to risetime relationship is about 0.4. Using this to calculate bandwidth will give you a ballpark figure that is sufficient for scope selection.

SAMPLE RATE AND WAVEFORM CAPTURE RATE

When considering digitizing oscilloscope characteristics and specifications, it's important to make a clear distinction between sample rate and waveform capture rate. A DSO's sample rate is specified in Samples per Second and indicates how frequently the scope samples the input signal. The waveform capture rate denotes how fast the scope can process acquired information after each trigger event and reset the trigger for another acquisition.

With higher sample rate, the signal is sampled more frequently allowing greater signal resolution. With higher waveform capture rate, the scope readies itself to be triggered more frequently allowing you to see any infrequent signal anomalies. The specified sample rate indicates nothing about how quickly the scope is reset for another trigger. The waveform capture rate indicates nothing about how often the signal is sampled. Yet when either sample rate or waveform capture rate are inadequate, important signal details can be missed.

The Importance of Adequate Sample Rate – The Nyquist sampling theorem states that the signal of interest must be sampled at least twice the rate of its highest frequency component to accurately reproduce it. While this is true "in theory", sometimes it isn't enough in practice. In reality, today's high speed digital signals should be sampled at least 5 times the rate of the highest frequency component (2.5 times the Nyquist rate) to be accurately reconstructed.

SELECTION GUIDE

		Channels				Bandwidth									
APPLICATION/PRODUCT		2-CH	2+2-CH	4-CH	IsolatedChannel™	<100 MHz	100 MHz	200 MHz	400 MHz	500 MHz	1 GHz	Over 1 GHz	InstaVu™	Digital Real-Time™	Sampling
Device Characterization	TDS 800	X				■	■	■	■	■	■	■			X
Design Debug/Comm Signal Analysis	TDS 700		X	X		■	■	■	■	■	■		X		
Design Characterization	TDS 600		X	X		■	■	■	■	■	■			X	
Design Debug/Comm Signal Analysis	TDS 500		X	X		■	■	■	■	■			X		
Personal Lab Scope	TDS 400	X		X		■	■	■	■						
Design & Service	TDS 300	X				■	■	■	■					X	
Test & Service	TDS 200	X				■	■							X	
Handheld Portable	THS 700	X			X	■	■	■						X	
Comm Signal Analysis/Device Characterization	11800/CSA	X		X		■	■	■	■	■	■	■			X

Oscilloscope Reference
Selection Guide

Digital Real-Time™ (DRT) – Tektronix DRT oscilloscopes are designed to acquire a waveform in a single trigger event up to the full rated bandwidth of the scope. With oversampling technology, DRT scopes capture the extremely fast edges encountered in digital design and permit high resolution timing measurements of multiple simultaneous events. Furthermore, DRT acquisition eliminates the need to use repetitive sampling techniques to attain full bandwidth performance.

InstaVu™ Acquisition – Improving DSO Waveform Capture Rate – DRT oscilloscopes simplify capture and analysis of predictable problems. But some of the most difficult fault patterns to detect in high speed electronic systems are related to infrequent variations in signals. Infrequent variations such as asynchronous noise, crosstalk, bus contention, marginal timing, signal dropouts, or an anomaly that occurs only once every million or so operations can require many hours (if not days) of acquisition time when using a scope with an inadequate waveform capture rate. Often such anomalies are simply overlooked entirely and critical information remains hidden within the signal.

Traditional DSOs capture only a few hundred waveforms per second, missing 99% of the signal while processing earlier acquisitions. This huge "dead time" is where critical signal details are most often missed. Tektronix developed InstaVu acquisition technology to eliminate the dead time normally associated with DSOs. InstaVu radically reduces the time between detectable trigger events, allowing you to see infrequent signal variations in real time. InstaVu acquisition transfers over 400,000 acquisitions to its display every second, even while viewing all channels simultaneously. Glitches that may have taken hours to find with a traditional DSO can be spotted in a few seconds with InstaVu acquisition. At 400,000 waveforms per second, InstaVu acquisition provides a thousand-fold improvement over traditional DSOs.

TRIGGERING

Extended triggering capabilities offered in most Tektronix oscilloscopes allow you to capture complex signals for device characterization or troubleshooting. They also provide more selective trigger control than is available with conventional edge triggering. In addition, their sophisticated user interfaces allow rapid setup of trigger parameters to increase productivity.

Tektronix DSOs allow you to trigger on pulses defined by amplitude (such as runt pulses), qualified by time (pulse width, glitch, slew rate, setup-and-hold, and time-out), and delineated by logic state or pattern (logic triggering). Combinations of extended and conventional triggers also help display video and other difficult-to-capture signals. Advanced triggering capabilities such as these deliver a large degree of flexibility when setting up testing procedures and can greatly simplify measurement tasks.

RECORD LENGTH

Maximum DSO record lengths are available from 1 K points to 8 M points. Tektronix DSOs provide adjustable record lengths that allow you to set the record length you need for a particular application – depending on the detail you need to see. If you are simply monitoring an extremely stable sinusoidal signal, for example, a 500 point record length may be adequate. But if you're trying to find the causes of timing anomalies in a complex digital data stream, a long record length is more appropriate. In addition, long record lengths provide the detail you need to capture and analyze single-shot events.

		Record Length							Triggering															
		1 K Max	2.5 K Max	15 K Max	50 K Max	120 K Max	500 K Max	8 M Max	Edge	Pulse	Logic	Video	Runt	Set-Up & Hold	Slew Rate	Automatic Measurements	Waveform Math	FFT	Standard Mask & Template Testing	Harmonic	Floppy Disk	Hard Drive	Color Display
Device Characterization	**TDS 800**	■	■	■					X							X	X	X					
Design Debug/Comm Signal Analysis	**TDS 700**	■	■	■	■	■	■	■	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Design Characterization	**TDS 600**	■	■	■					X	X	X	X	X	X	X	X	X	X			X		X
Design Debug/Comm Signal Analysis	**TDS 500**	■	■	■	■	■	■	■	X	X	X	X	X	X	X	X	X	X	X		X	X	
Personal Lab Scope	**TDS 400**	■	■	■	■	■			X			X				X	X	X			X		
Design & Service	**TDS 300**	■							X			X				X	X	X			X		
Test & Service	**TDS 200**	■	■						X			X				X	X	X					
Handheld Portable	**THS 700**	■	■						X	X		X				X	X			X			
Comm Signal Analysis/Device Characterization	**11800/CSA**	■	■	■					X							X	X	X	X				X

Oscilloscope Reference
Data Management

Data Management Solutions for Oscilloscopes

Digitizing oscilloscopes produce incredible amounts of data and information about waveforms. So much, in fact, that it is often hard to make the best use of it. In addition, programmable scopes open doors to a wide range of possibilities for test and procedure automation.

Tektronix offers several software solutions to these data management and control problems with software for:

- Saving and recalling waveforms and settings
- Handling graphic images of screens and waveforms for documentation
- Data logging
- Procedure generation and execution
- Data analysis and graphics
- Remote control

Here's a brief summary of the packages and the products they support.

Product Name	Product Number	Description	Oscilloscopes Supported
WaveStar™	WSTR31	Capture waveforms, settings and notes; restore waveforms and settings; copy waveforms to word processing and spreadsheet analysis application software	11401, 11402/A, 11403/A, 11801/B, 11802, CSA 404, CSA803/A, DSA 601/A, DSA602/A, 2212, 2216 2220, 2221A, 2230, 2232, 2430/A, 2432/A, 2440, TDS 200, TDS 300, TDS 400, TDS 500, TDS 600, TDS 700, TDS 800 Series, THS 700 Series
LabWindows®/CVI	S3FG910/912 LWCVI	data acquisition, analysis, and instrument control	TDS Series, 2200 DSOs
LabVIEW*[1] PC Windows	LVWIN	data acquisition, analysis, and graphics	TDS Series, 11801B, CSA 803A, 2200 DSOs, RTD 720A
WaveWriter™	S3FT400	waveform capture generation and editing	TDS Series, 2200 DSOs
TTiP i-Pattern	TTIP	Telecommunications templates and i-Pattern analysis	TDS 400A, TDS 500C, TDS 600B, TDS 700C

*[1] *LabVIEW is a registered trademark of National Instrument Corporation.*

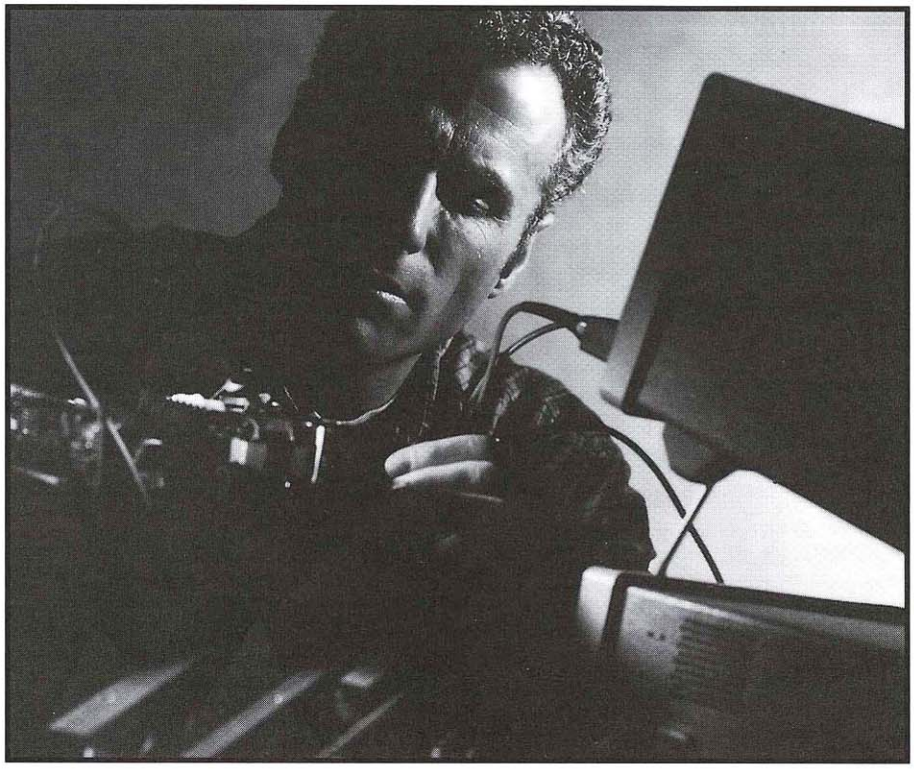
Oscilloscope Reference
Technology

Tektronix Oscilloscopes and Communication Signal Analyzers

These products include many innovative features designed to improve productivity and reduce operating costs. Tektronix oscilloscopes represent the best combination of performance features, human factors and price on the market today. There are other vital technologies only available from Tektronix such as:

- InstaVu Acquisition gives the highest waveform capture rate available in any oscilloscope – over 400,000 waveforms per second – to capture those infrequent signal anomalies in debugging applications
- Color-graded displays which give a statistical look at jitter and noise
- Digitizing oscilloscopes with extraordinary power to capture fast transient signals, process them on the fly and measure their parameters
- The TDS 600 helps digital designers quickly zero in on complex logic problems in high-speed digital systems
- The TDS 700/TDS 500C and CSA communication analyzers give an accurate assessment of noise, jitter and compliance to ITU and ANSI Standards. Up to 50 GHz bandwidth with 2.0 ps RMS jitter (1.3 ps typically) is available in the CSA 803A
- The High Bandwidth (50 GHz) 11801B offers the highest timing resolution and measurement repeatability. While the TDS 800 combines the sequential equivalent-time sampling technology of the 11801B with the mid-range TDS platform for DC-8 GHz bandwidth in a portable monolithic instrument
- Using oversampling technology, Digital Real-Time™ Oscilloscopes offer single-event waveform capture to their full bandwidth
- DC to 50 MHz current measurements
- Affordable digital signal processing

For complete information on all Tektronix oscilloscope accessories, please see page 438.



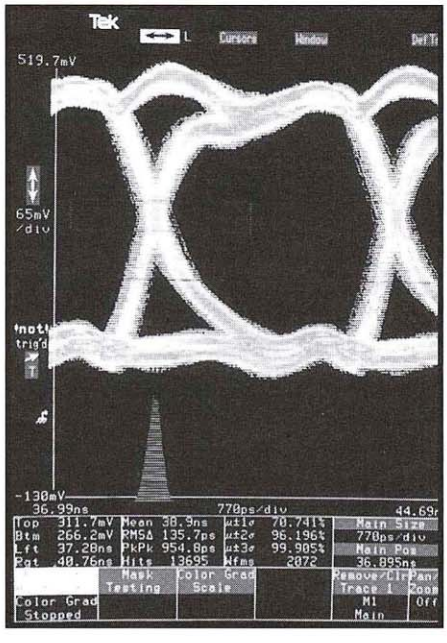
General Trends in Oscilloscope Development

Today you will find more and more special purpose oscilloscopes, such as the TDS 500C and TDS 700C with their communications options, CSA 803A and 11801B with bandwidth to 50 GHz and color graded display for thorough analysis of high-speed communication channels and standards testing.

Our TDS Series scopes include powerful digital signal processing engines which can give you simultaneous time and frequency domain displays with fast updates.

Our scopes are constantly getting easier to use. We've reversed the trend toward more buttons and menus. Our new models achieve a balance between performance and ease of use. We've done our homework, tested our ideas and greatly improved access to important new features without making the basic functions hard to find. Volts/division, time/division and trigger level have dedicated knobs so you can just grab and turn.

Measurement, trigger modes, hard copy setups and acquisition control lie within easy reach behind a graphic user interface (GUI). Information-packed displays are made easy to read with a high-resolution color monitor.



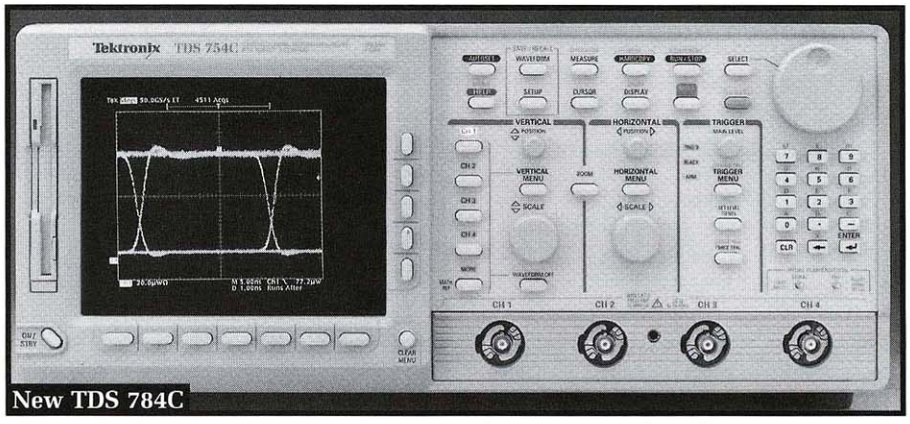
Documentation of waveforms is simplified by direct storage of screens (in common file formats) to floppy disk for cut and paste into word processing software, or through the use of software such as Tektronix' WaveStar™ Electronic Lab Notebook.

Oscilloscope Reference
New Products

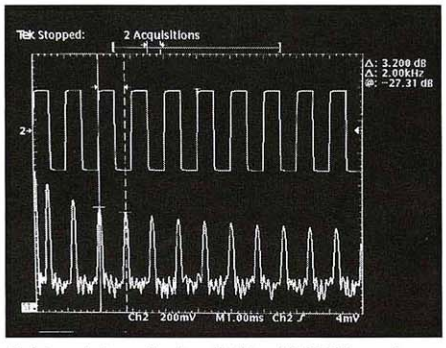
New Models

The new TDS 700C and TDS 500C Series sets new industry standards for performance and feature-packed capability in an oscilloscope. They are designed to keep pace with current and evolving needs in advanced electronic design and debug applications. They also offer powerful new features such as mask testing, mask autoset and built-in optical reference receivers, to tackle communication design and R & D applications.

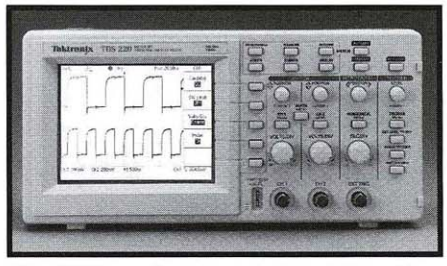
The new TDS 200 Series Digital Real-Time™ oscilloscopes offer the performance and advantages of digital technology but at the cost of analog. These 60 MHz and 100 MHz oscilloscopes offer 2 channels sampling at 1 GS/s on each channel. In addition, these products feature dual timebase, autoset, waveform and setup storage, robust, backlit LCD and a multilanguage user interface. Both products are housed in a compact, lightweight chassis.



The new TDS 784C captures over 400,000 waveforms per second to allow you to instantly view even the rarest signal events. The communications option provides the most comprehensive solution for capturing and characterizing optical and electrical signals in high-speed communication designs.



Tektronix' exclusive TriStar™ DSP engine brings simultaneous time and frequency domain analysis to mid-range scopes in the TDS 400, TDS 500, TDS 600, TDS 700 and TDS 800 products.



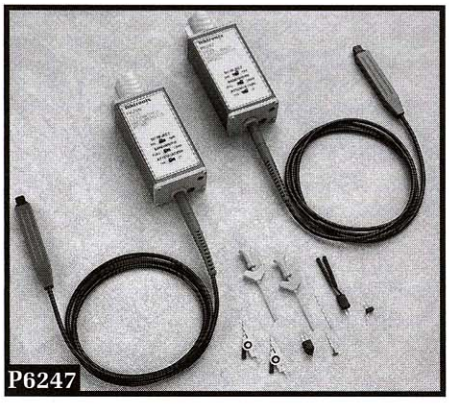
The TDS 200 Series Digital Real-Time™ oscilloscopes offer the ease of use and low costs of analog but with the performance advantages of digital.

Oscilloscope Reference
Accessories

Oscilloscope Reference Section

PROBES AND ACCESSORIES

Tektronix continues to dedicate research and development resources to helping customers find ways to connect instrumentation to the changing variety of today's new devices and packages. You will find some innovative new probes and connecting schemes that quickly and cleanly couple to all kinds of devices.



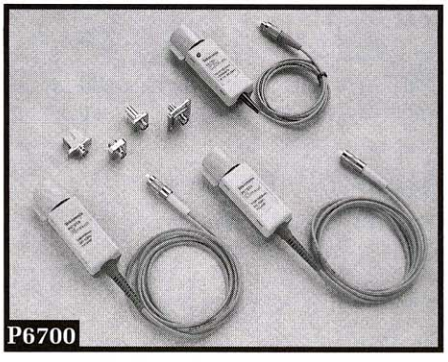
P6247/P6246 HIGH SPEED DIFFERENTIAL

The P6246 and P6247 enable users to make time domain or frequency domain measurements on high bandwidth signals commonly found in disk drive, digital IC design, and communication applications.

The small probe head geometry and assorted probe tip accessories allow these probes to easily accommodate manual probing of surface mount devices while maintaining high CMRR.

The P6246 and P6247 are ideal for design verification of disk drive read channel electronics, timing analysis, or troubleshooting ground bounce problems associated with high speed logic. They can also be used for pulse shape or cross talk compliance testing at high speed communication signals.

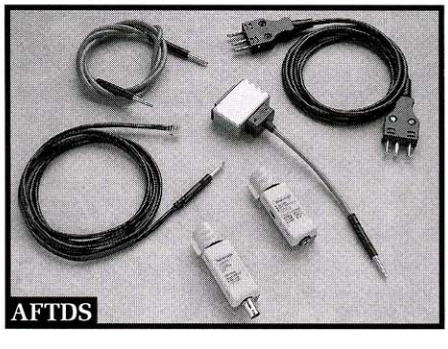
See page 496.



P6700

The Tektronix P6700 Series optical-to-electrical (O/E) convertors change optical signals into electrical signals for convenient analysis on Tektronix TDS Series oscilloscopes equipped with the TEKPROBE interface, or any other oscilloscope when used with the 1103 TEKPROBE power supply. The P6700 Series O/E converters are ideal for optical source characterization in the development, manufacture, or service of optical communication systems and devices.

See page 336.



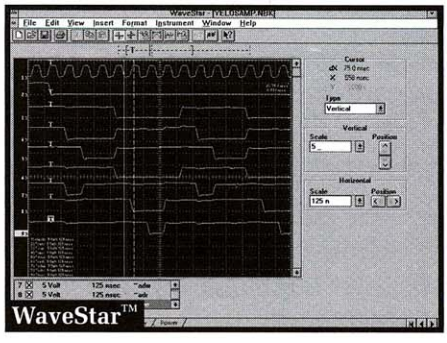
AFTDS

The AFTDS Differential Signal Adapter and the AMT75 75 Ω Adapter provide an effective means for 50 Ω terminated instruments to connect to and analyze differential and high speed electrical communication signals as well as video signals.

Both adapters are rugged and have the TEKPROBE interface which provides convenient autoscaling of waveforms on Tektronix TDS Series oscilloscopes. Also the low VSWR (Return Loss) performance minimizes measurement errors commonly associated with interfacing with complex electrical signals.

Ideal for use in pulse shape compliance testing of high speed electrical communication signals.

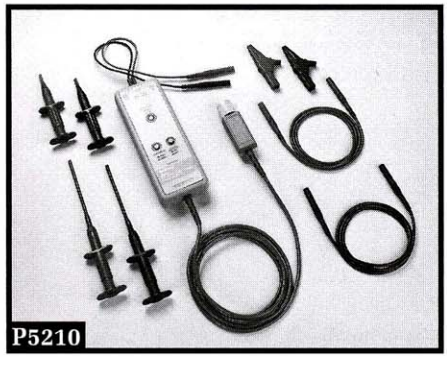
See page 334.



WAVEFORM CAPTURE SOFTWARE

WaveStar Software version 1.1 is an enhanced Windows application program from Tektronix that allows the user to quickly create an electronic lab notebook within their personal computer to record Tektronix Digital Storage Oscilloscope (DSO) measurements. The notebook can be used to record waveforms and/or screen shots, related scope settings, and notes. Further, WaveStar Software provides a simple link to spreadsheet and documentation software, enabling users to analyze measurement records or incorporate them within other published materials.

See page 112.



DIFFERENTIAL SIGNAL ACQUISITION SOLUTIONS

Four products are available for acquiring differential signals. The ADA400A 1 MHz Differential Preamplifier allows single-ended oscilloscope measurements of very low signal levels (<10 μV) that are not ground referenced. The P5200, P5205, P5210 Differential Probes measure differential voltages up to 5,600 V and have bandwidths up to 100 MHz. The new P5210 Differential Probe measures differential voltages up to 5,600 V. With a bandwidth of 50 MHz, the P5210 probe easily measures those fast dV/dt transitions in switching power devices.

See page 500.

Oscilloscopes
TDS • THS • 11800 • CSA

CONTENTS

TDS SERIES OSCILLOSCOPES

General Information/Selection Guide...57,58
TDS 820 8 GHz....64
TDS 784C 1 GHz....68
TDS 754C 500 MHz....68
TDS 724C 500 MHz....68
TDS 684B 1 GHz....74
TDS 680B 1 GHz....74
TDS 644B 500 MHz....74
TDS 640A 500 MHz....74
TDS 620B 500 MHz....74
TDS 540C 500 MHz....68
TDS 520C 500 MHz....68
TDS 510A 500 MHz....77
TDS 460A 400 MHz....79
TDS 430A 400 MHz....79
TDS 420A 200 MHz....79
ADA400A....82
TDS 380 400 MHz....83
TDS 360 200 MHz....83
TDS 340A 100 MHz....83
TDS 220 100 MHz....87
TDS 210 60 MHz....87

THS 700 SERIES HANDHELD BATTERY OPERATED OSCILLOSCOPE/DMM

THS 710A 60 MHz....90
THS 720A 100 MHz....90
THS 730A 200 MHz....90
THS 720P 100 MHz....92

11800 SERIES OSCILLOSCOPES/PLUG-INS

11801B 50 GHz Digital Sampling....95, 97
IPA 510 Interconnect Parameter Analyzer....108
Sampling Heads....102

CSA SERIES COMMUNICATIONS SIGNAL ANALYZERS

CSA 803A Up to 50 GHz Color....95, 330

TVS 600A SERIES VXI WAVEFORM ANALYZERS

TVS 645A/TVS 641A....372
TVS 625A/TVS 621A....372

ACCESSORIES....438

SOFTWARE

TTIP....66
WaveStar™....112
LabWindows/CVI....384
LabVIEW PC Windows....384
Wavewriter....391

TDS Series

An innovative series of advanced performance oscilloscopes built upon Tektronix' digitizing oscilloscope platform, featuring multi-processor speed and flexibility, advanced acquisition and triggering capabilities and a unique graphical user interface for intuitive operation.

TDS 700/500 Series

The TDS 700/500 Series have the fastest waveform capture rate available. They offer a well rounded package of high-fidelity acquisition, advanced triggering, automatic measurements and communication signal analysis. TDS 700/500 are the most powerful debug tools for communication design applications.

TDS 600 Series

The TDS 600 Series provides design engineers the best tool for characterizing their digital designs. They offer the highest performance levels of Digital Real-Time™ scopes and a powerful set of triggering and measurement functions.

TDS 400 Series

For professionals who demand high precision and fidelity from their measurements, the TDS 400 combines excellent performance and a broad feature set, all at affordable prices.

TDS 300 Series

The TDS 300 Series Digital Real-Time™ Oscilloscopes set a new price/performance standard. Each input channel is independently oversampled to acquire signals over its entire bandwidth, even when measuring high-speed transient or single shot events at the fastest sweep speed. Their intuitive interface combines dedicated knobs with menu-driven functions. Built in floppy disk drive, 21 automatic measurements, FFT analysis, and four different display modes are standard in all three models.

TDS 200 Series

Tektronix introduces the TDS 200 Series Digital Real-Time™ oscilloscopes, for engineers and technicians who need a compact, easy to use, low cost oscilloscope that will improve productivity and measurement quality. There is no better combination of performance, reliability, and affordability. The controls will be familiar to analog oscilloscope users both in function and format. Automatic measurements, stored waveforms, and other digital functions are controlled by on-screen menus in any of ten user-selectable languages.

THS 700 Series

The award winning THS700 Series now includes: 200 MHz version – the highest performance handheld scope/DMM in the market. Power version – the first handheld scope to include automatic power measurements, statistics, and harmonics measurements. All four models in the new TekScope THS700 Series feature Isolated Channels at full bandwidth with Digital Real-Time™ sampling technology. A true RMS digital multimeter is a standard feature in the rugged, battery operated handheld package.

11800/CSA Series

The 11801B/CSA803A series of oscilloscopes provide comprehensive measurement capabilities from DC to 50 GHz. The modular design of these oscilloscopes allows you to tailor the performance of your scope to meet specific application needs. You can select between a wide range of plug-in sampling heads that provide various different levels of bandwidth and noise performance, and can select sampling heads and probes offering different input impedances.

Oscilloscopes
TDS Series

Features

TDS SERIES

- 60 MHz to 8 GHz Bandwidth
- 100 MS/s to 5 GS/s Sample Rates
- 2 and 4 Input Channels
- Advanced Logic Pattern and State Triggering
- Runt and Glitch Triggering
- HDTV Video Triggering
- Infinite and Variable Persistence Displays
- High-resolution Color Display
- Record Lengths to 8M Points
- 8- to 13-Bit Vertical Resolution
- Tektronix TriStar™ DSP for Fast Waveform Processing and Live Measurement Updates
- DSP Math Including FFT, Integration, and Differentiation
- Communication Signal Analysis Including Mask Testing, Mask Autoset, and SDH/SONET and Fibre Channel Optical Reference Receivers
- Automatic Measurements
- Pass/Fail Testing
- Easy Documentation with Saving of Image Files to Floppy Disk or Hardcopies Directly to Printer
- Full GPIB Programmability

Applications

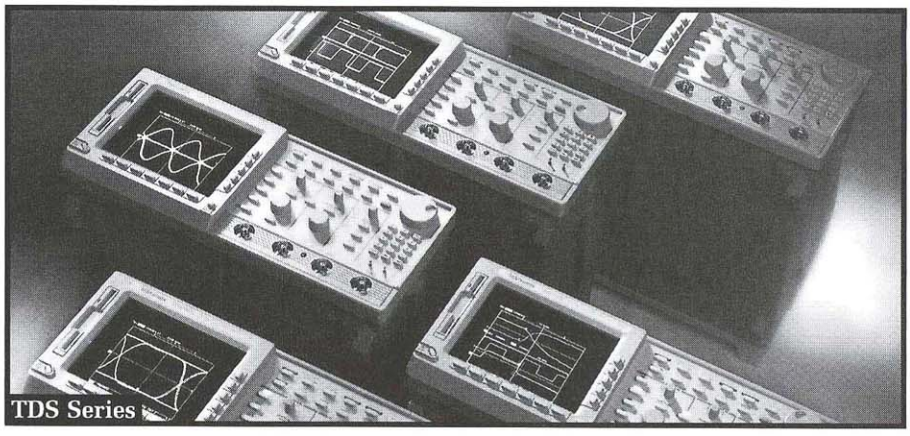
- Research and Development
- Electromechanical Design
- Telecom Design and R&D
- Biophysical, Biomedical Research
- Power Supply Design
- Component Development and Characterization
- Service and Repair

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*


TDS Series

TDS Series

An innovative series of oscilloscopes built upon Tektronix' digitizing oscilloscope platform, featuring multi-processor speed and flexibility, advanced acquisition and triggering capabilities and a unique graphical user interface for intuitive operation.

With the TDS Series, Tektronix introduced a new and innovative generation of digitizing oscilloscopes designed to keep pace with current and evolving needs across the electronics industry. TDS combines the performance needed with the ease of use demanded by customers in digital design; research and development; electromechanical design; power supply design; biophysical/biomedical high-speed component development and characterization; and telecommunications design and automated test.

The TDS Series offers significant advantages over other oscilloscopes in four major areas:

HIGH-FIDELITY SIGNAL ACQUISITION

TDS offers sample rates ranging from 100 MS/s to 5 GS/s and bandwidths from 60 MHz to 8 GHz. TDS couples this performance with wide dynamic range, vertical resolution up to 13-Bits, fast overdrive recovery and 1 mV/div sensitivity. You'll find a model that precisely fits your needs.

POWERFUL AND FLEXIBLE TRIGGERING

TDS 500, 600 and 700 models feature very innovative and accessible logic triggering features that can isolate glitches, runts and timing problems quickly and reliably. Video triggering for NTSC, PAL, SECAM and custom video standards makes the TDS 400 an excellent choice for video and display system design. Specialized HDTV triggering is available on the TDS 500, TDS 600 and TDS 700. 2 GHz trigger bandwidth in the TDS 800 and very low jitter make it ideal for high-speed component characterization and for telecommunications manufacturing, installation and maintenance.

The TDS family has been recognized for innovation and technology leadership by leading industry periodicals since its introduction in 1991.

MULTIPROCESSOR ARCHITECTURE

Our TriStar Digital Signal Processor complements a multi-processor design in all TDS Scopes to permit more measurement flexibility, instant response to commands and live waveform math including FFT and waveform pass/fail testing in the TDS 400, 500, 600, 700 and 800. Displays may be sent directly to a printer or plotter or exported as EPS (Encapsulated Postscript) or PCX (Microsoft Windows) files for use with common graphics and word processing software.

AFFORDABLE PERFORMANCE THAT IS EASY TO USE

A graphical user interface (GUI) makes operation intuitive. A familiar front-panel layout puts dedicated knobs for vertical, horizontal and trigger controls right where you expect to see them. This layout makes it easy for casual users to operate the basic oscilloscope features. Explanatory icons, pop-up menus, online help and the VGA-quality display quickly guide users to even the most powerful measurement features. A color VGA display is available with the TDS 600, and 700.

Digitizing Oscilloscopes

TDS Series Selection Guide: See page 60 for Footnote Explanations

		TDS 210*13	TDS 220*13	TDS 340A	TDS 360	TDS 380	TDS 420A	TDS 430A	TDS 460A
SIGNAL ACQUISITION SYSTEM	Bandwidth	60 MHz	100 MHz	100 MHz	200 MHz	400 MHz	200 MHz	400 MHz	400 MHz
	Channels	2	2	2	2	2	4	2	4
	Sample Rate: 1-CH	1 GS/s	1 GS/s	500 MS/s	1GS/s	2GS/s	100 MS/s	100 MS/s	100 MS/s
	2-CH	1 GS/s	1 GS/s	500 MS/s	1GS/s	2GS/s	100 MS/s	100 MS/s	100 MS/s
	3- and 4-CH	–	–	–	–	–	100 MS/s	–	100 MS/s
	Record Length: Standard	2.5 K pts.	2.5 K pts.	1 K pts.	1 K pts.	1 K pts.	30 K pts.	30 K pts.	30 K pts.
	Optional	–	–	–	–	–	120 K pts.	120 K pts.	120 K pts.
	Vert. Resolution: Normal	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits
	w/ Averaging	8-Bits	8-Bits	11-Bits	11-Bits	11-Bits	11-Bits	11-Bits	11-Bits
	w/ HiRes	–	–	–	–	–	≥12-Bits	≥12-Bits	≥12-Bits
	Vert. Sensitivity (/div)	2 mV to 5 V	2 mV to 5 V	2 mV to 10 V			1 mV to 10 V		
	Vertical Accuracy	±3%	±3%	±2%	±2%	±2%	±1.5%	±1.5%	±1.5%
	Max Input Voltage (1MΩ)	±300 V	±300 V	±400 V	±400 V	±400 V	±400 V	±400 V	±400 V
	Linear Dynamic Range	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div
	BW Limit	20 MHz	20 MHz	20 MHz	20 MHz	20 MHz	20, 100 MHz	20, 100 MHz	20, 100 MHz
	Time Base: Range	5 ns to 5s	5 ns to 5s	5 ns to 5 s	2.5 ns to 5 s	1 ns to 5 s	1 ns to 20 s	1 ns to 20 s	1 ns to 20 s
	Accuracy	100 ppm	100 ppm	100 ppm	100 ppm	100 ppm	50 ppm	50 ppm	50 ppm
	Peak Detection	10 ns	10 ns	10 ns	10 ns	10 ns	10 ns	10 ns	10 ns
	FastFrame™*4	–	–	–	–	–	–	–	–
	Roll Mode*5	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
	Channel Deskew	–	–	–	–	–	–	–	–
	InstaVu™ Acq. Mode	–	–	–	–	–	–	–	–
TRIGGERING	Trigger Conditioning	HF, LF, Noise Reject		HF, LF, Noise Reject			HF, LF, Noise Reject		
	Types: Edge	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
	Pattern/State	–	–	–	–	–	–	–	–
	Setup & Hold	–	–	–	–	–	–	–	–
	Pulse Width	–	–	–	–	–	–	–	–
	Glitch	–	–	–	–	–	–	–	–
	Runt Pulse	–	–	–	–	–	–	–	–
	Slew Rate	–	–	–	–	–	–	–	–
	Time Out	–	–	–	–	–	–	–	–
	Comm	–	–	–	–	–	–	–	–
	External	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
	Video*6	Std.	Std.	Std.	Std.	Std.	Opt.	Opt.	Opt.
	Modes: Delay by Time/Event	By Time only	By Time only	By Time only	By Time only	By Time only	Std.	Std.	Std.
SIGNAL PROCESSING	Auto. Measurements	5	5	21	21	21	25	25	25
	Math	+, –, inv	+, –, inv	+, –, x	+, –, x	+, –, x		+, –, x, inv	
	Envelope	–	–	Std.	Std.	Std.	Std.	Std.	Std.
	Average	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
	Interpolation*7	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
	FFT, Int., Diff.	–	–	Std.*8	Std.*8	Std.*8	Opt.	Opt.	Opt.
	Limit Test	–	–	–	–	–	Std.	Std.	Std.
GENERAL	Display Monitor	Mono	Mono	Mono	Mono	Mono	Mono	Mono	Mono
	Display Modes: Var. Persist.	Two Level	Two Level	Two Level	Two Level	Two Level	Gray Scale	Gray Scale	Gray Scale
	Inf. Persist, Vectors, Dots, YT, XY	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
	Waveform Capture Rate*9	180 wfms/s	180 wfms/s	86 wfms/s	86 wfms/s	86 wfms/s	200 wfms/s	200 wfms/s	200 wfms/s
	Data Ports: VGA Out	–	–	Opt.	Opt.	Opt.	Std.	Std.	Std.
	GPIB	Opt.	Opt.	Opt.	Opt.	Opt.	Std.	Std.	Std.
	RS232	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.*11	Opt.*11	Opt.*11
	Centronics	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.
	Hardcopy/Export Formats*12	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
	Disk Drive (3.5 in.)	–	–	Std.	Std.	Std.	Std.	Std.	Std.
	On-line Help	–	Std.	–	–	–	Std.	Std.	Std.
	Standard Probes	2 ea P6112 100MHz, 10X Passive		2 ea. P6109B	2 ea. P6111B	2 ea. P6114B	4 ea.	2 ea. P6138A 400MHz,10X Passive	4 ea.

*1 to *14 See page 60.

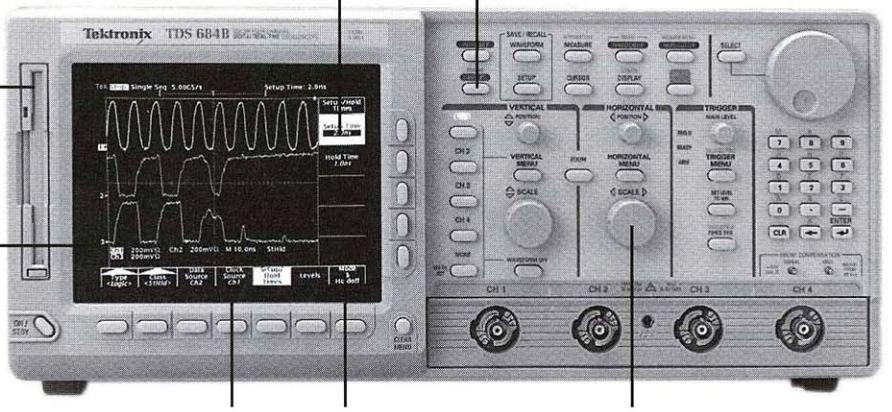
Digitizing Oscilloscopes

TDS Series Selection Guide: See page 60 for Footnote Explanations

TDS 510A	TDS 520C	TDS 540C	TDS 620B	TDS 644B	TDS 680B	TDS 684B	TDS 724C	TDS 754C	TDS 784C	TDS 820
500 MHz	500 MHz	500 MHz	500 MHz	500 MHz	1 GHz	1 GHz	500 MHz	500 MHz	1 GHz	6-8 GHz*1
4	2+2	4	2+2	4	2+2	4	2+2	4	4	2
500 MS/s	1 GS/s	2 GS/s	2.5 GS/s	2.5 GS/s	5 GS/s	5 GS/s	1 GS/s	2 GS/s	4 GS/s	50kS/s
500 MS/s	500 MS/s	1 GS/s	2.5 GS/s	2.5 GS/s	5 GS/s	5 GS/s	500 MS/S	2 GS/s	2 GS/s	50kS/s
250 MS/s	–	500 MS/s	–	2.5 GS/s	–	5 GS/s	–	1 GS/s	1 GS/s	–
50 K pts	50 K pts.	50 K pts.	15 K pts.	15 K pts.	15 K pts.	15 K pts.	50 K pts.	50 K pts.	50 K pts.	15 K pts.
–	4M pts.*2	8M pts.*3	–	–	–	–	4M pts.*2	8M pts.*3	8M pts.*3	–
8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	8-Bits	14-Bits
11-Bits	11-Bits	11-Bits	11-Bits	11-Bits	11-Bits	11-Bits	11-Bits	11-Bits	11-Bits	–
≥13-Bits	≥13-Bits	≥13-Bits	–	–	–	–	≥13-Bits	≥13-Bits	≥13-Bits	–
1 mV to 10 V			1 mV to 10 V				1 mV to 10 V			2mV to 200mV*11
±1%	±1%	±1%	±1.5%	±1.5%	±1.5%	±1.5%	±1%	±1%	±1%	±0.7%
±400 V	±400 V	±400 V	±400 V	±400 V	±400 V	±400 V	±400 V	±400 V	±400 V	±6 V*11
±5 div	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div	±5 div
20, 100 MHz			20, 250 MHz				20, 250 MHz			–
500 ps to 10 s			200 ps to 10 s				500 ps to 10 s	500 ps to 10 s	200 ps to 10 ms	20 ps to 2 ms
25 ppm			100 ppm				25 ppm	25 ppm	25 ppm	0.1% +15 ps
2 ns	1 ns	1 ns	1 ns	1 ns	1 ns	1 ns	1 ns	1 ns	1 ns	–
–	372 frames	372 frames	–	–	–	–	372 frames	372 frames	372 frames	–
–	–	–	–	–	–	–	–	–	–	–
–	±25 ns	±25 ns	±25 ns	±25 ns	±25 ns	±25 ns	±25 ns	±25 ns	±25 ns	–
–	Std.	Std.	–	–	–	–	Std.	Std.	Std.	–
HF, LF, Noise Reject			HF, LF, Noise Reject				HF, LF, Noise Reject			–
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
4 inputs	4 inputs	4 inputs	4 inputs	4 inputs	4 inputs	4 inputs	4 inputs	4 inputs	4 inputs	–
–	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
1 ns	1 ns	1 ns	2 ns	2 ns	2 ns	2 ns	1 ns	1 ns	1 ns	–
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
–	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
–	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
–	Opt.	Opt.	–	–	–	–	Opt.	Opt.	Opt.	–
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	Opt.	–
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
25	29	29	25	25	25	25	29	29	29	27
+, –, x, ÷, inv			+, –, x, ÷, inv				+, –, x, ÷, inv			+, –, x, ÷, inv
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Opt.	Opt.	Opt.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Opt.
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Mono	Mono	Mono	Mono	Color	Mono	Color	Color	Color	Color	Mono
Gray Scale			Gray Scale	Color Grade	Gray Scale	Color Grade	Color Grade			Gray Scale
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
150	≥180,000*10	≥400,000*10	145	145	145	145	≥180,000	≥400,000	≥400,000	35
wfms/s	wfms/s	wfms/s	wfms/s	wfms/s	wfms/s	wfms/s	wfms/s*10	wfms/s*10	wfms/s*10	wfms/s
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Opt.*11	Opt.*11	Opt.*11	Std.*11	Std.*11	Std.*11	Std.*11	Std.*11	Std.*11	Std.*11	Opt.*11
Opt.	Opt.	Opt.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Opt.
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	–
Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.	Std.
4 ea.	2 ea.	4 ea.	2 ea.	4 ea.	None	None	2 ea.	4 ea.	None	2 ea. P6207
P6139A 500MHz,10X Passive			P6139A	P6243			P6139A 500MHz,10X Passive			4GHz,10X FET

**1 to *14 See page 60.*

Digitizing Oscilloscopes
TDS Series Selection Guide



TDS 684B

TDS SELECTION GUIDE FOOTNOTES

**1 With Option 1D: Bandwidth = 8 GHz. Vertical Sensitivity = 1mV - 100mV/div. Max Input = ±3V, no pre-trigger.*

**2 Optional record length on TDS524C/724C is: Opt. 1M: 250K pts (1-CH), 130K pts per channel (2-CH); Opt. 2M: 4M pts (1-CH), 2M pts (2-CH).*

**3 Optional record length TDS 540C/754C/784C: Opt 1M: 500K pts (1-CH), 250K pts per channel (2-CH), 130K pts (3-, 4-CH). Opt 2M: 8M pts (1-CH), 4M pts (2-CH), 2M pts (3-, 4-CH).*

**4 Maximum frames, from 50 - 5K points per frame.*

**5 TDS400A triggered and untriggered roll. TDS300 untriggered roll only.*

**6 TDS 300: NTSC, PAL; TDS 400A: NTSC, PAL, SECAM; TDS 500B/600B/700A: NTSC, PAL, SECAM, HDTV, FlexFormat™.*

**7 Selectable Sin x/x, linear. TDS300: Sin (x)/x only.*

**8 TDS300: FFT only.*

**9 Typical specification, in waveforms per sec (wfms/s). Specification indicates typical performance for 500 pt record length and infinite persistence mode selected.*

**10 In InstaVu™ acquisition mode on 1-CH. In normal mode, value is 150 wfms/s.*

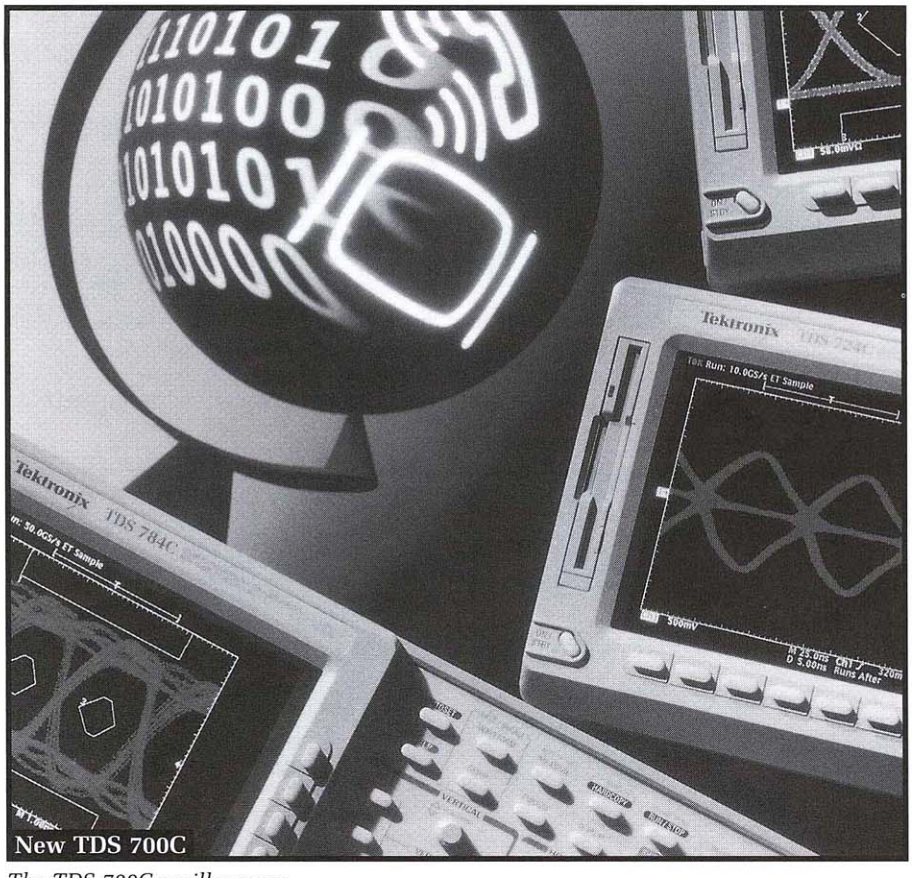
**11 Talk mode only, for hardcopy purposes.*

**12 Supported formats: TIFF, BMP, PCX, RLE, Interleaf (IMG), PostScript, LaserJet, Epson, Thinkjet, Deskjet, DPU411/412. TDS300/400A/500B/600B/700A also support Spreadsheet, MathCad™ waveform formats. TDS200 support: Epson, Thinkjet, Deskjet, Laserjet, BMP, PCX, EPS, Interleaf.*

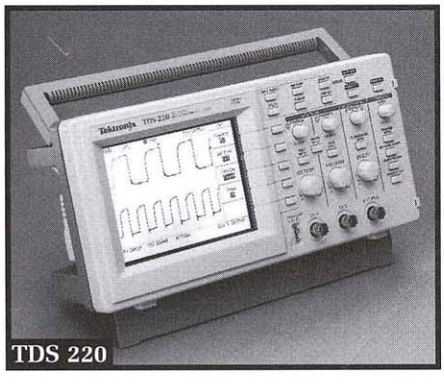
**13 UI menus in 10 languages.*

**14 Certain restrictions on range apply based on other instrument settings. Consult detailed data sheets for details.*

Digitizing Oscilloscopes
TDS Series



The TDS 700C oscilloscopes.

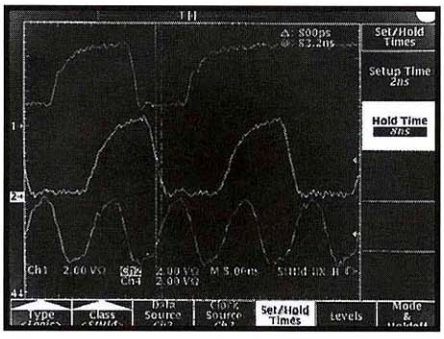


The TDS 400A Digitizing Oscilloscopes and AM 503S Current Probe System. The AM 503S and TDS 400A combination are well suited for measuring currents in switching supplies.

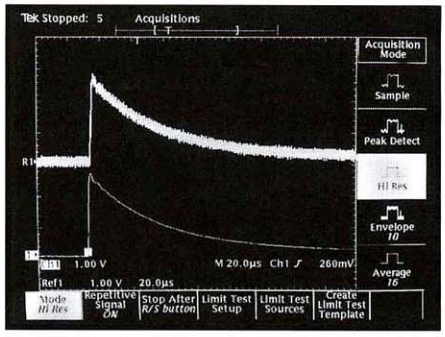
Digitizing Oscilloscopes
TDS Series

Powerful Acquisition

- Four Channels of 5 GS/s (TDS 684B)
- Record Lengths of 8,000,000 Points (TDS 500C/TDS 700C, Opt. 2M)
- Up to 8 GHz Bandwidth (TDS 820, Opt. 1D)



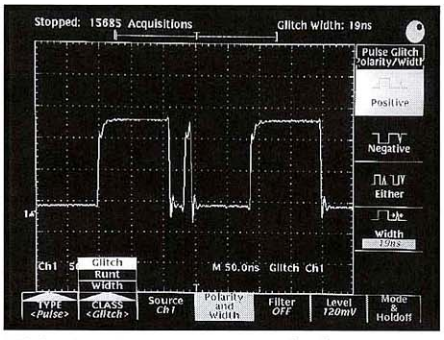
The TDS 684B provides four channels of 5 GS/s acquisition to capture events with high single-shot resolution.



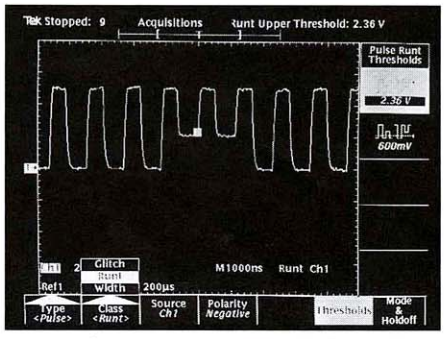
Hi-Res acquisition mode achieves extremely high signal to noise ratios (SNR) on single-shot events by oversampling the input signal.

Advanced Triggering

- Glitch Triggering (TDS 500C/TDS 600B/TDS 700C)
- Exclusive Runt Triggering (TDS 500C/TDS 600B/TDS 700C)
- HDTV Video Triggering (TDS 500C/TDS 600B/TDS 700C)
- Setup and Hold Time Violation Triggering (TDS 500C/TDS 600B/TDS 700C)
- Slew Rate Triggering (TDS 500C/TDS 600B/TDS 700C)
- Communication Standard Triggering (TDS 500C/TDS 700C, Opt. 2C)



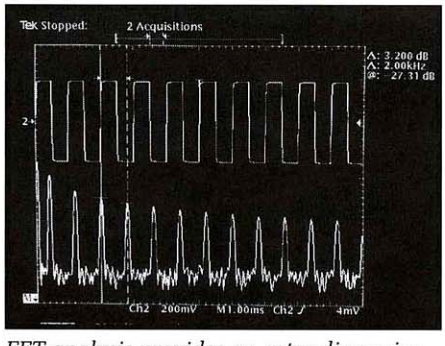
TDS triggering can capture glitches as narrow as 1 ns to help solve prototype circuit problems quickly.



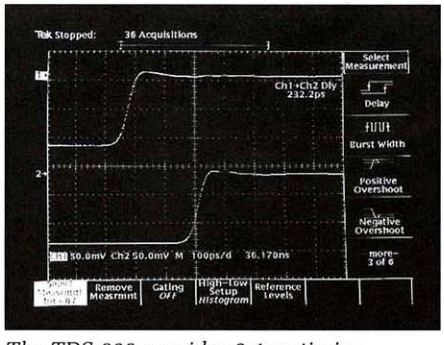
TDS exclusive runt triggering helps isolate invalid logic levels such as those caused by setup and hold violations.

Powerful Processing

- FFT Analysis
- Manufacturing Pass/Fail Testing
- On-board Mask Compliance Testing (TDS 500C/TDS 700C, Opt. 2C)



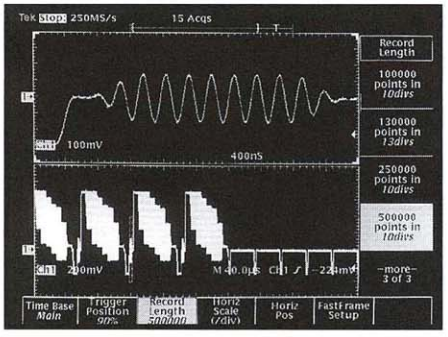
FFT analysis provides an extra dimension of performance with simultaneous displays in the time and frequency domains.



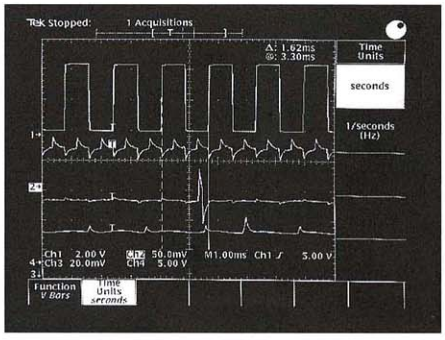
The TDS 820 provides 0.4 ps timing resolution and channel deskew capability to accurately measure delays in today's high-speed digital systems.

Digitizing Oscilloscopes
TDS Series

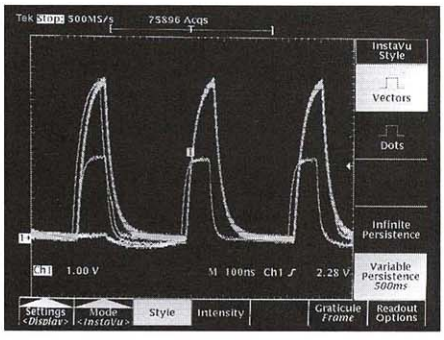
Powerful Acquisition



Record lengths of up to 8M points (TDS 500C/700C, Opt. 2M) enable very high timing resolution on even the most complex waveforms. Or capture unexpected events that happen well before or long after the trigger event.

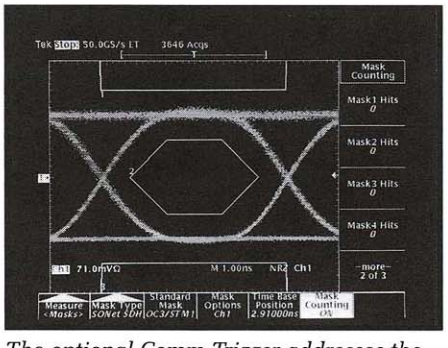


Four channels help show a time-correlated display of both digital control and analog feedback signals.

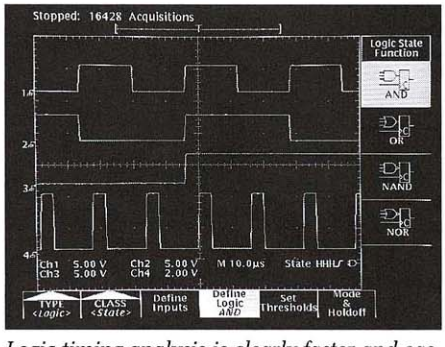


InstaVu™ acquisition mode adds a third dimension to your waveforms. InstaVu has the fastest waveform capture rate – over 400,000 waveforms per second – and it provides a graded historical view of waveform changes in 16 levels of color (TDS 700C) or levels of gray (TDS 500C).

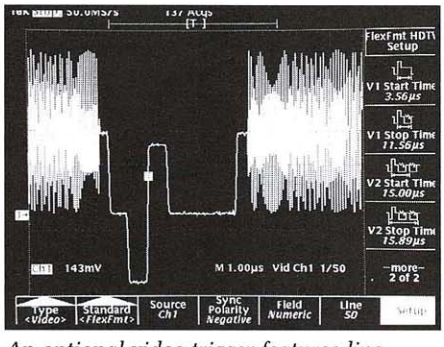
Advanced Triggering



The optional Comm Trigger addresses the need to acquire a wide variety of AMI, CMI and NRZ communication signals. (TDS 500C/TDS 700C, Opt. 2C).

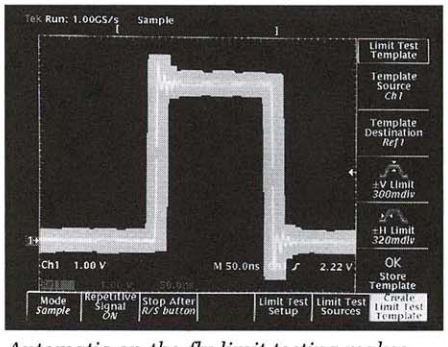


Logic timing analysis is clearly faster and easier with icon-driven state triggering.

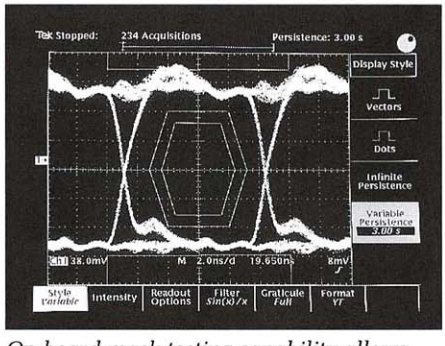


An optional video trigger features line and field selection on standard and user definable HDTV formats.

Powerful Processing



Automatic on-the-fly limit testing makes manufacturing pass/fail testing an easy task (all TDS 400A, TDS 500C, 600B, 700C and 800 models).



On-board mask testing capability allows comparison of signals to standard masks in communication systems (TDS 820/ TDS 500C/TDS700C, Opt. 2C).

Digitizing Oscilloscopes
TDS 820

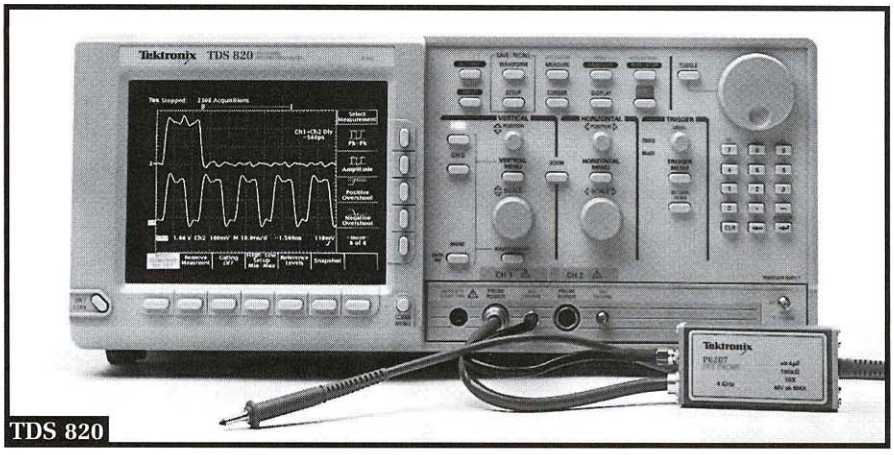
Features

TDS 820

- Sampling Oscilloscope
- 6-8 GHz BW
- 0.4 ps Timing Resolution
- 2 Input Channels
- 20 ps/div to 2 ms/div Sweep Speeds in 5 ps Steps
- 2 GHz External Trigger Bandwidth
- 3 ps RMS Jitter
- Infinite and Variable Persistence Displays
- 14-Bit Vertical Resolution
- 27 Automatic Measurements
- Electronic Mask Drawing and Display
- Automatic Pass/Fail Limit Testing
- Full GPIB Programmability
- Optional Hardcopy Interface
- Optional Advanced DSP Waveform Math Including FFT, Integration and Differentiation
- 0.5 pF FET Probes Standard

Applications

- Telecom Service and Manufacturing
- Semiconductor Characterization
- Digital System Design and Characterization



TDS 820

SIGNAL ACQUISITION SYSTEM	TDS 820	TDS 820 Opt. 1D
Channels	2	2
Rise time	58.3 ps	43.8 ps
Bandwidth (0.35/rise time)	6 GHz	8 GHz
Max operating input voltage	2 V p-p; ±3 V DC	1 V p-p; ±1.5 V DC
Sensitivity	2 m V/div to 200 mV/div	1 mV/div to 100 mV/div
Random noise	1.2 mV max, 600 µV typical	600 µV max, 300 µV typical

DC Gain Accuracy – ±0.7% after user-initiated automatic vertical calibration.

Vertical Resolution – 14-Bits (Approx. 16,384 levels over 10.24 vertical divisions).

Input Impedance – 50 Ω.

ACQUISITION MODES

Normal – One sample acquired with each trigger event.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform averages selectable from 2 to 10,000.

TIME BASE SYSTEM

Time Bases – Main, Delayed.

Time/Division Range – 20 ps/division to 5 ms/division in 1-2-5 steps or settable from the numeric keypad in 5 ps steps.

Delta time measurement accuracy –

Time interval	Accuracy
Ti ≥1 ns	0.1% x interval +15ps
100 ps	5 ps
10 ps	2 ps

Channel Deskew – Up to 100 ns (each channel).

Record Length – 500, 1000, 2000, and 5000, and 15,000 samples per channel.

Pre-Trigger View Time – 1.5 ns.

TRIGGERING SYSTEM

Trigger Sources – External input, internal rate generator, CH 1, CH 2.

External Trigger Sensitivity – 40 mV p-p from DC to 200 MHz, increasing linearly to 200 mV p-p at 2 GHz.

External Trigger Minimum Pulse Width – 0.25 ns.

Internal Trigger Sensitivity – 80 mV p-p from DC to 200 MHz, increasing linearly to 400 mV p-p at 1 GHz.

Trigger Delay Jitter – 3 ps RMS + 30 ppm of time base delay.

Holdoff Range – 15 µs to 2 s.

DISPLAY

Waveform Style – Dots or vectors. Infinite and variable persistence from 250 ms to 10 s.

Gray Scaling – With variable persistence selected, waveform points gradually decay through 16 levels of intensity, providing "z-axis" information about rapidly changing waveforms.

Graticules – Full, grid, cross hair, frame.

Format – YT and XY.

CRT Type – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 White phosphor.

CRT Resolution – 640 horizontal by 480 vertical displayed pixels.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digitizing Oscilloscopes
TDS 820

MEASUREMENT SYSTEM
Automatic Waveform Measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+ Duty Cycle	– Duty Cycle
+ Overshoot	– Overshoot
Propagation Delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Phase	Cycle Area
+ Cross	– Cross
Area	

Continuous update of up to four measurements on any combination of waveforms. Snapshot mode shows all measurements on the selected waveforms.

Thresholds – Settable in percentage or voltage.

Cursor Measurements – Absolute, Delta; Volts, Time, Frequency.

Cursor Types – Horizontal bars (volts); Vertical bars (time); Paired (volts and time).

WAVEFORM PROCESSING
Waveform Functions – Interpolate-selectable sin(x)/x or linear, Average, FFT, integrate, and differentiate.

Arithmetic Operators – Add, Subtract, Multiply, Invert.

Autosetup – Single button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

COMPUTER INTERFACE
GPIB (IEEE-488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARD COPY
Formats – HP ThinkJet, Epson, Postscript, Interleaf, DeskJet, LaserJet, EPS Monochrome, EPS Color, TIFF, PCX, BMP, HPGL.

Optional Hardcopy Interface – Centronics and RS-232C.

STORAGE
Waveforms – Up to 15 K points.

Setups – 10 front-panel setups.

POWER REQUIREMENTS
Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 47 to 63 Hz.

Power Consumption – 250 W max.

ENVIRONMENT AND SAFETY
Temperature – Operating: 0 to +50°C. Nonoperating: –40 to +75°C.

Humidity – Operating and nonoperating: Up to 95% relative humidity at or below +40°C; to 75% relative humidity from +41°C to 50°C.

Altitude – Operating: 15,000 ft. Nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve # 1, RE-02, Part 7; meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart B, Class A.

Safety – Listed UL 3111-1. Certified to CAN/CSA-C22.2 No. 1010.1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	193	7.6
with acc. pouch	236	9.3
Width	445	17.5
Depth with front cover	432	17.0
Weight	**kg**	**lbs.**
Net	13.2	29.1
Shipping	23.6	52.0

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TDS 820
2-CH, 8 GHz Digitizing Oscilloscope.
Includes: Two P6207 Probes; Reference (070-8511-01), User Manual (070-8512-01), Programmer Manual (070-8513-01), Performance Verification Manual (070-8696-00), U.S. Power Cord (161-0230-01), Two 12-inch 50 Ω Male-to-Male SMA Cables (174-1364-00), 60-inch 50 Ω Male-to-Male SMA Cable (174-1428-00), Antistatic Grounding Wrist Strap (006-3415-04), SMA "T" (015-1016-00), SMA Female-to-Female Adapter (015-1012-00), Two SMA Short Circuit Male Terminations (015-1020-00), Front Cover (200-3696-00).

Opt. 1D – Delete internal delay line for full 8 GHz bandwidth.

Opt. 2D – Delete Two P6207 Probes.

Opt. 13 – RS-232/CENTRONICS Hardcopy Interface.

Opt. 1R – Rackmount.

Opt. B1 – Service Manual.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1–A5 available.
See General Customer Information Section for description.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

RECOMMENDED ACCESSORIES
Also see page 438.

PROBES

Active – 3.5 GHz, 0.4 pF/100 kΩ, 1 m. Order P6207.

Differential – 1 GHz, active differential, 6 ft. Order P6247. (Requires 1103 Power Supply.)

50 Ω Divider – 9 GHz, 0.15 pF/500 Ω, Tips 1X, 10X. 1 m. Order P6150.

CARTS – Order K420 Scope Cart.

Static Isolation Unit – Order SIU800.

SOFTWARE
WSTR31 – WaveStar™ waveform capture and documentation software.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

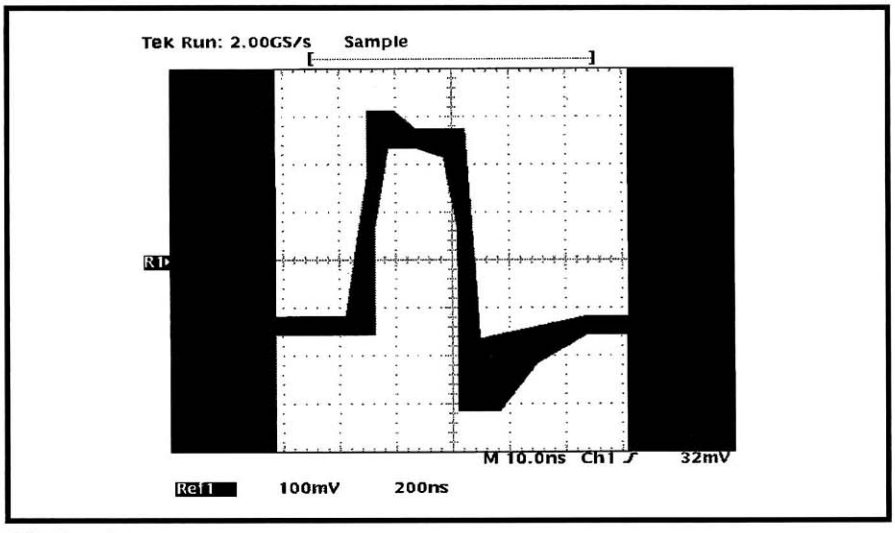
Digitizing Oscilloscopes

TTiP i-Pattern™

Features

TTiP

- Compare Live Signals to Industry Standard Templates
- Oscilloscope Setup Files Provided for Convenience
- Pass/Fail Testing of Acquired Signal
- i-Pattern Software for Statistical Measurement, Examination of Signal Noise and Timing Jitter
- Set of Nine Optical Standard Masks Provided with i-Pattern Software



DS1 Template.

TDS Telecommunication Package

One of the most frequently performed tasks in the design, manufacture and service of telecommunications equipment is comparing the live signals to a predefined industry standard template. The TTiP telecommunications package for the TDS 400A/500C/600B/700C models provides the user with the capability to make this comparison. In addition, the i-Pattern software lets you analyze and visually examine signal noise and timing jitter on IBM compatible PCs.

PRE-DEFINED TEMPLATES AND SCOPE SETUPS

The TTiP package includes twenty-seven pre-defined templates, simplifying what used to be a time-consuming and inaccurate measurement task.

Appropriate oscilloscope setup files for the TDS 400A/500C/600B/700C scopes are also provided. These setup files simplify the task of aligning the signal with the templates. For TDS without internal disk drives, the templates and setup files are available in GPIB formats.

PASS-FAIL TESTING

Once the signal is aligned and scaled, you can choose to perform the Pass/Fail test on the acquired signal. The TDS oscilloscope's limit testing capability makes it simple to determine if the signal passes or fails to meet the standard.

i-Pattern Software and Telecommunication Masks

The i-Pattern software provides statistical measurements and visual examination of signal noise and timing jitter by importing captured waveforms from the oscilloscope via GPIB to the PC. There the waveforms can be stored and analyzed.

The operation of the i-Pattern software is simplified by the integration of "drop-down" menus and pop-ups, intuitive use of arrow keys, use of "hot-keys," command short cuts, and extensive on-line HELP. A set of nine Optical Standard Masks to be used with the software is provided.

REQUIRED CONFIGURATION

The i-Pattern software requires a GPIB connection to the TDS scope for waveform retrieval. The following configuration is recommended for the normal operation of i-Pattern software: a TDS oscilloscope connected via GPIB cable to a IBM-PC/AT or compatible controller with a National Instruments GPIB interface card: GPIB-PC, GPIB-PC2, GPIB-PC2A, MC-GPIB, AT-GPIB or GPIB PCIII and a 3.5 in. floppy disk drive.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TTIP
Telecommunication Package and i-Pattern Software.

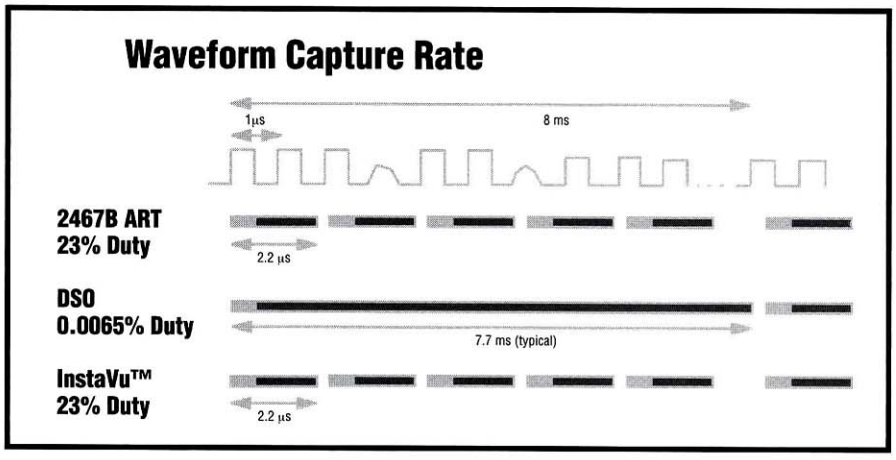
Includes: TDS Template and Setup Files on 3.5 in. Floppy; GPIB Templates and Setup Files and i-Pattern Software with Predefined Telecommunication Masks on 3.5 in. Floppy; User Manuals.

InstaVu™ Acquisition Mode

Features

InstaVu ACQUISITION

- Delivers the Fastest Waveform Capture Rate (400,000 wfms/sec)
- Instantaneous Capture of Glitches and Infrequent Anomalies in Fraction of the Time Relative to Non-InstaVu Acquisition DSOs
- Acquisition Rates on a DSO Faster than the Worlds Fastest Analog Oscilloscopes

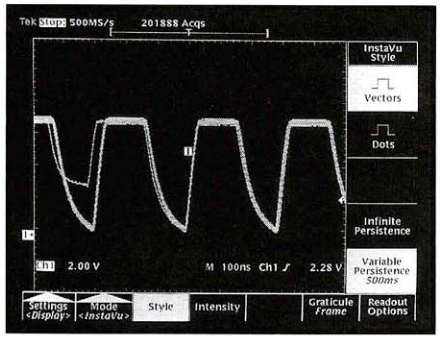


InstaVu Acquisition Mode

The TDS 700C/TDS 500C family introduces InstaVu Acquisition mode which provides the world's fastest waveform capture rate. Prior to InstaVu Acquisition mode, sporadic signal events could only be captured with a Tektronix 2467B and 7104 with their Micro-Channel Plate (MCP) display. The TDS 700C/TDS 500C oscilloscopes with InstaVu Acquisition mode can capture waveforms even faster than the world's fastest analog scopes.

With waveform capture rates exceeding 400,000 waveforms per second, InstaVu Acquisition allows you to instantaneously capture glitches and signal anomalies that could take hours for a state-of-the-art digitizing oscilloscope in persistence mode to capture or that would be completely missed by common analog scopes. Today's state-of-the-art DSOs can only capture a maximum of a couple hundred real-time waveforms per second, which translates to about an 8 ms hold-off between acquisitions or 0.0065%of the time actually spent on acquiring data. In comparison, InstaVu Acquisition has a minimum hold-off between acquisitions of only 1.7 µs, which means that it is acquiring a signal 23% of the time – a 3500 times increase over a state-of-the-art DSO! Therefore, with InstaVu Acquisition you will instantly capture glitches that you've either had to wait a long time for, or that you never knew existed.

A button dedicated to InstaVu Acquisition instantly moves you between standard DSO acquisition modes and InstaVu mode. Push the InstaVu button to instantly see what is going on in your system, and then push the button again to go back to standard DSO modes to isolate and analyze any anomalies found with InstaVu Acquisition by using the TDS 700C/TDS 500C's specialized triggers and advanced math. Like an analog scope, InstaVu Acquisition provides a single screen of data, and it shows intensity information (relative occurrence of events) using color grading. Unlike an analog scope, InstaVu Acquisition can perform automatic measurements and save screen images to disk or to a printer. Moreover, you also have the full utility of the world's most advanced digitizing oscilloscopes at the push of a button.



For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

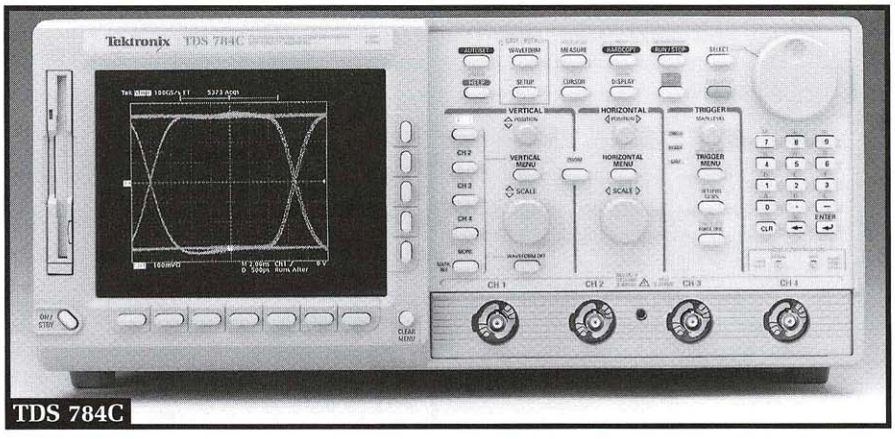
Tektronix Measurement products are manufactured in ISO registered facilities.

InstaVu™ Acquisition Oscilloscopes

TDS 500C • TDS 700C

Features

- 1 GHz and 500 MHz Bandwidth
- Sample Rates to 4 GS/s
- Up to 400,000 Wfms/s
- 2 or 4 Channels
- 1% Vertical Accuracy
- 8-Bit Vertical Resolution, over 11-Bits with Averaging, and Over 13-Bits with Hi-res
- 1 ns Peak Detect
- 1 mV to 10 V/div Sensitivity
- Up to 1 GHz Differential Measurements
- Channel Deskew
- Record Lengths to 8M Points
- Floppy and Hard Disk Storage
- Advanced Triggering
- 29 Automatic Measurements and Measurement Statistics
- FFT and Advanced Math
- Waveform Histograms
- Limit Test
- Communication Signal Analysis Including Mask Testing and SONET/SDH and Fibre Channel Optical Reference Receivers
- Full GPIB Programmability
- 3 Year Warranty



TDS 784C

The TDS 500C/TDS 700C Family of Digitizing Oscilloscopes

The TDS 500C/700C oscilloscopes are the latest in the TDS family of digitizing oscilloscopes designed to keep pace with current and evolving needs in advanced electronic design and debug. They are also powerful tools for communication design and R&D applications.

At over 400,000 waveforms per second, the TDS 500C and TDS 700C products with InstaVu™ Acquisition have the fastest waveform capture rate available on an oscilloscope. They allow you to instantly view even the rarest signal events.

Like the other members of the TDS series, the TDS 500C and TDS 700C products have a well-rounded combination of a graphical user interface, high-fidelity acquisition, advanced triggering, automatic measurements, and complementary measurement accessories.

EASY TO LEARN AND EASY TO USE

Extensive user interface design has made the TDS family of products truly intuitive to operate. Each family member shares a familiar front panel layout with dedicated vertical, horizontal, and trigger controls. A graphical user interface with over 200 icons helps facilitate understanding and use of the advanced features. A color monitor helps rapidly distinguish between multiple waveforms and measurements. On-line help provides a convenient built-in reference manual.

HIGH FIDELITY SIGNAL ACQUISITION

The high waveform capture rate of the TDS 500C/700C InstaVu series, together with its high bandwidth and sample rate, delivers instantaneous signal feedback to show the true signals that other scopes may be missing. InstaVu acquisition acquires waveforms over 1000 times faster than any other DSO, allowing the capture of intermittent signals, reducing debugging times from hours to seconds

Channels can be transparently combined to achieve higher sample rates and longer record lengths. The record length can be optionally increased to 8M points, providing a high-resolution representation of the signal over a long period of time.

All of the TDS products provide wide dynamic range, flat response, fast overdrive recovery, calibrated DC offset, 1 mV/div sensitivity, 1 ns peak detect, and internal calibration.

POWERFUL AND FLEXIBLE TRIGGERING

In addition to basic triggering such as edge and pulse-width, these TDS oscilloscopes have several trigger modes tailored for specific design and debug applications. Logic and pulse triggers, including setup/hold, glitch, slew rate, and timeout triggers, capture hard-to-catch digital design problems. The optional video trigger provides line and field selection for NTSC, PAL, and HDTV standards. The optional comm trigger addresses needs to acquire a wide variety of AMI, CMI, and NRZ communication signals.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

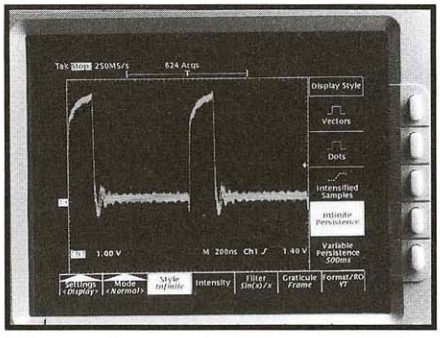
See Tektronix on the World Wide Web: http://www.tek.com

CE

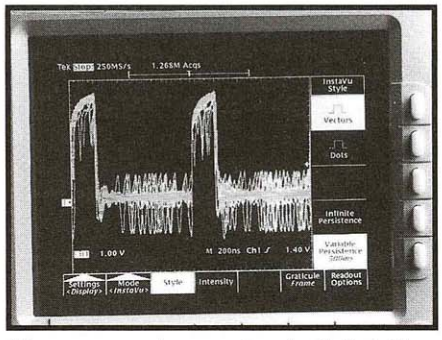
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

InstaVu™ Acquisition Oscilloscopes

TDS 500C • TDS 700C



This waveform, captured in normal DSO mode, shows a well-behaved, repetitive digital waveform.



The same waveform, captured with InstaVu acquisition, uncovers detail in the signal which goes unnoticed by a common DSO.

ADVANCED PERFORMANCE FEATURES

The TDS products use a **Multiprocessor Architecture**, which includes a Tektronix TriStar™ digital signal processor and a powerful proprietary display processor, to provide the power for waveform math, high-speed averaging, automatic limit testing, mask testing, live measurements, and variable persistence display.

Color-Graded Variable Persistence displays historical information that has been acquired over time. This is especially powerful when used in InstaVu™ mode, where the colors show relatively how often random glitches occur.

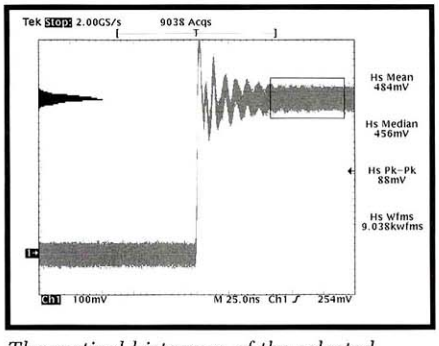
Automatic Measurements eliminate the need for manually measuring the waveform against the graticule or with cursors. Measurement gating allows the user to select a specific part of the live waveform for measurement. Measurement statistics (min, max, mean, and standard deviation), give additional information about the variations in the measurements over time (for example, worst case excursions), increasing the confidence in the quality of the measurements.

Advanced Waveform Processing provides FFT signal analysis and signal integration and differentiation.

Waveform Histograms allow the examination of the statistical nature of the signal. Horizontal histograms, which are useful for evaluating signal jitter, sample the waveform within a specified region, sort the values into time bins, and plot the accumulated bin values versus time. Vertical histograms, which are useful for evaluating signal noise, sample the waveform within a specified region, sort the values into amplitude bins, and plot the accumulated bin values versus amplitude.

Limit Testing compares acquired or math waveforms against a template "on-the-fly", stopping acquisition, saving to disk, or automatically printing the waveform whenever it violates the template.

Communication Mask Testing (available as an option) allows mask compliance testing of a wide variety of communication signals to industry standards. Specialized measurement accessories, unique trigger modes, built-in optical reference receiver filters, mask autoset, and mask violation counting make these measurements easily and repeatably.

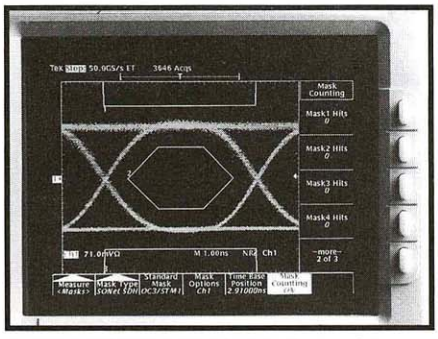


The vertical histogram of the selected region of the waveform shows the character of the noise.

Channel Deskew allows increased measurement accuracy by correcting inter-channel timing errors up to ±25 ns introduced by propagation delays in circuit probing.

COMPLEMENTARY MEASUREMENT ACCESSORIES

Tektronix provides a wide range of measurement accessories optimized for the TDS family. These accessories are designed to operate via the TEKPROBE® interface, which provides power and automatic scaling, to complete the TDS measurement solutions.



A SONET/SDH (OC-3/STM-1) signal is compared with the standard mask, showing a compliant waveform.

Active Probes such as the P6243 and P6245 active probes were designed specifically for the TDS products. For example, the P6245 is capable of achieving the full 1 GHz bandwidth on a 1 GHz TDS while providing low loading (1 pF capacitance and 1 MΩ resistance). The low-mass compact design of these probes makes them ideal for hands-free probing of fine-pitch surface-mount devices.

Optical-to-Electrical Converters (P6701B, P6703B) allow convenient analysis of optical transmission signals with the oscilloscope. Both short- and long-wavelength optical converters are compatible with the industry-standard wavelengths for SONET/SDH and Fibre Channel.

High-bandwidth Differential Probes (P6246, P6247) enable high bandwidth (up to 1 GHz) differential measurements while maintaining high common-mode rejection. The small probe head design and assorted tip accessories allow easy probing of SMDs. These probes provide low circuit loading and are ESD-rugged.

Current Probes such as the TCP202 and High-Voltage Differential Probes such as the P5205 and P5210 allow safe, high-power measurements. Direct Probe Readouts use information from the probes to display measurements in units of Amps, Volts, and Watts.

SOPHISTICATED DOCUMENTATION

Save screen displays in a number of standard desktop publishing formats to the internal 3.5 in. DOS-compatible floppy disk drive. Transfer the disk to a PC for import into word processing applications. Make hardcopies directly to monochrome or color printers and plotters connected to the GPIB, RS-232, or Centronics ports, or acquire waveforms, screen displays, and scope settings using Tektronix WaveStar™ software running on a PC interfaced to the GPIB port.

InstaVu™ Acquisition Oscilloscopes

TDS 500C • TDS 700C

TDS 500C/700C SERIES ELECTRICAL CHARACTERISTICS

	TDS 784C	TDS 754C	TDS 724C	TDS 540C	TDS 520C
Bandwidth	1 GHz*1	500 MHz*2	500 MHz*2	500 MHz*2	500 MHz*2
# Channels	4	4	2 + 2 aux.	4	2 + 2 aux.
# Samplers	4	4	2	4	2
Max Real-time Sample Rate					
1 channel	4 GS/s	2 GS/s	1 GS/s	2 GS/s	1 GS/s
2 channels	2 GS/s	2 GS/s	500 MS/s	1 GS/s	500 MS/s
3-4 channels	1 GS/s	1 GS/s	NA	500 MS/s	NA
Equivalent-time Sample Rate	250 GS/s max.	100 GS/s max.	100 GS/s max.	100 GS/s max.	100 GS/s max.
Maximum Record Length					
1 channel	50 K (opt. 1M: 500 K, opt. 2M: 8 M)	50 K (opt. 1M: 500 K, opt. 2M: 8 M)	50 K (opt. 1M: 250 K, opt. 2M: 4 M)	50 K (opt. 1M: 500 K, opt. 2M: 8 M)	50 K (opt. 1M: 250 K, opt. 2M: 4 M)
2 channels	50 K (opt. 1M: 250 K, opt. 2M: 4 M)	50 K (opt. 1M: 250 K, opt. 2M: 4 M)	50 K (opt. 1M: 130 K, opt. 2M: 2 M)	50 K (opt. 1M: 250 K, opt. 2M: 4 M)	50 K (opt. 1M: 130 K, opt. 2M: 2 M)
3-4 channels	50 K (opt. 1M: 130 K, opt. 2M: 2 M)	50 K (opt. 1M: 130 K, opt. 2M: 2 M)	NA	50 K (opt. 1M: 130 K, opt. 2M: 2 M)	NA
Max Sample Rate Window*3	2 ms	4 ms	4 ms	4 ms	4 ms
Display	NuColor™	NuColor™	NuColor™	monochrome	monochrome

**1 In 50 Ω mode: 5 mV/div: 750 MHz, 2 mV/div: 600 MHz, 1 mV/div: 500 MHz. Reduce the upper bandwidth frequencies by 5 MHz for each °C above 30°C.*

**2 In 50 Ω mode: 1 mV/div: 450 MHz. Reduce the upper bandwidth frequencies by 2.5 MHz for each °C above 30°C.*

**3 Single-channel operating at full sample rate and maximum record length (Opt. 2M).*

TDS 500C/700C SERIES VERTICAL SYSTEM

	TDS 784C	TDS 754C	TDS 724C	TDS 540C	TDS 520C
Sensitivity	1 mV/div to 10 V/div (1 MΩ mode), 1 mV/div to 1 V/div (50 Ω mode)				
DC Gain Accuracy	±1.0% (±0.7% typical)	±1.0% (±0.7% typical)	±1.0% (±0.7% typical)	±1.0% (±0.7% typical)	±1.0% (±0.7% typical)
Effective Bits (typical)	5.5 (1 GHz @ 4 GS/s), 9.7 with Hi-res (1 MHz @ 10 MS/s)	6.8 (500 MHz @ 2 GS/s), 9.7 with Hi-res (1 MHz @ 10 MS/s)	6.5 (490 MHz @ 1 GS/s), 9.7 with Hi-res (1 MHz @ 10 MS/s)	6.8 (500 MHz @ 2 GS/s), 9.7 with Hi-res (1 MHz @ 10 MS/s)	6.5 (490 MHz @ 1 GS/s), 9.7 with Hi-res (1 MHz @ 10 MS/s)
Vertical Resolution	8-Bits (256 levels on 10.25 divisions), >11-Bits with averaging, >13-Bits typical with Hi-res (TDS 784C), >12-Bits typical with Hi-res (TDS 754C, TDS 724C, TDS 540C, TDS 520C)				
Position Range	±5 divisions	±5 divisions	±5 divisions	±5 divisions	±5 divisions
Offset Range	±1 V from 1 mV to 100 mV/div, ±10 V from 101 mV to 1 V/div, ±100 V from 1.01 V to 10 V/div				
Analog Bandwidth Selections	20 MHz, 250 MHz, full	20 MHz, 250 MHz, full	20 MHz, 250 MHz, full	20 MHz, 250 MHz, full	20 MHz, 250 MHz, full
Input Coupling	AC, DC, GND	AC, DC, GND	AC, DC, GND	AC, DC, GND	AC, DC, GND
Input Impedance Selections	1 MΩ in parallel with 10 pF, or 50 Ω (AC and DC coupling)				
AC-coupled Low Frequency Limit	≤10 Hz when AC 1 MΩ coupled. ≤200 kHz when AC 50 Ω coupled.				
Channel Isolation	>100:1 at 100 MHz and >30:1 at the rated bandwidth for any 2 channels having equal V/div settings				
Max. Input Voltage	300 V CAT II ±400 V (peak). Derate at 20 dB/decade above 1 MHz. 1 MΩ or GND coupled.				

TDS 500C/700C SERIES TIMEBASE SYSTEM

	TDS 784C	TDS 754C/TDS 724C/TDS 540C/TDS 520C
Time Bases	Main, delayed	Main, delayed
Time Base Range	200 ps to 10 s/div	500 ps to 10 s/div
Time Base Accuracy	±25 ppm (over any interval ≥1 ms)	
Pre-trigger Position	0% to 100% of any record	
Delay Between Channels	≤50 ps (any 2 channels with equal V/div and coupling)	

InstaVu™ Acquisition Oscilloscopes

TDS 500C • TDS 700C

TDS 500C/700C Series Characteristics

ACQUISITION MODES

InstaVu – Instantaneous capture of random glitches and changing signals. Captures over 400,000 waveforms per second (TDS 784C, TDS 754C, and TDS 540C) or 180,000 wfms/s (TDS 724C and TDS 520C). Uses color grading (TDS 700Cs) to show relative occurrence of events.

Peak Detect – High frequency and random glitch capture. Captures glitches of 1 ns using acquisition hardware at all real-time sampling rates.

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform data from 2 to 10,000 (selectable) is averaged.

Hi-res – Vertical resolution improvement and noise reduction on low-frequency signal (e.g., 13-Bits typical for the TDS 784C at 50 ms/div and slower, 12-Bits typical for the other TDS 700C/500C instruments).

FastFrame™ – Acquisition memory size segmentable with trigger rate up to 50,000 per second from 50 to 5,000 points per frame (independent of the number of channels).

Single Sequence – Use RUN/STOP button to capture a single triggered acquisition at a time, which may be automatically saved to NVRAM with AutoSave.

TRIGGER SYSTEM

Triggers – Main and delayed.

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delayed by time, events, or events and time.

Time Delay Range – 16 ns to 250 s.

Events Delay Range – 1 to 9,999,999 events.

External Rear Input – ≥1.5 kW ; Max input voltage is ±20 V (DC + peak AC).

TRIGGER TYPES

EDGE (Main and Delayed) – Conventional level-driven trigger. Positive or negative slope on any channel or rear panel auxiliary input. Coupling selections: DC, AC, noise reject, HF reject, LF reject.

LOGIC (Main) –
PATTERN: Specifies a logical combination (AND, OR, NAND, NOR) of the four input channels (high, low, don't care). Trigger when pattern stays true or false for a specified time.
STATE: Any logical pattern of channels 1, 2, and 3 (AUX1 on 2-CH products) plus a clock edge on channel 4 (AUX2 on 2-CH products). Triggerable on rising or falling clock edge.
SETUP/HOLD: Trigger on violations of both setup time and hold time between clock and data which are on two input channels.

PULSE (Main) –
GLITCH: Trigger on or reject glitches of positive, negative, or either polarity. Minimum glitch width is 1.0 ns with 200 ps resolution.
RUNT: Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.
WIDTH: Trigger on width of positive or negative pulse either within or out of selectable time limits (1 ns to 1 s).
SLEW RATE: Trigger on pulse edge rates that are either faster or slower than a set rate. Edges can be rising, falling, or either.
TIMEOUT: Trigger on an event which remains high, low, or either, for a specified time period, selectable from 1 ns to 1 s, with 200 ps resolution.

COMM (Optional) –
AMI: Trigger on standard communications signals (including DS1, DS1A, DS1C, DS2, DS3, E1, E2, E3, STS-1, or a custom bit rate). Select between "isolated ones" (positive or negative) and eye diagrams.
CMI: Trigger on standard communications signals (including STS-3, STM1E, DS4NA, E4, or a custom bit rate). Select between positive or negative one pulses, zero pulses, and eye diagrams.
NRZ: Trigger on standard communications signals (including OC1/STM0, OC3/STM1, OC12/STM4, E5, FC133, FC266, FC531, FC1063, FDDI HALT, 143 Mb/s serial digital composite video, 270 Mb/s serial digital component video, or a custom bit rate). Select between an eye diagram, rising or falling edges, or any of eight 3-Bit serial patterns.

VIDEO (Optional) – Trigger on a particular line of individual, odd/even, or all fields. Trigger on a specific pixel of a line by using the video trigger with delay by events. Choose positive or negative horizontal sync polarity.
525/NTSC: Choose monochrome or color (studio-quality NTSC) sync formats.
625/PAL: Choose color or monochrome (studio-quality PAL) sync formats.
HDTV: Choose from 1125/60, 1050/60, 1250/50, and 787.5/60 HDTV formats.

FlexFormat™ – Define HDTV-type formats by defining frame rep rate, numbers of lines and fields, and vertical sync timing structure.

MEASUREMENT SYSTEM

Automatic Waveform Measurements – Period, frequency, + width, – width, rise time, fall time, + duty cycle, – duty cycle, delay, phase, burst width, high, low, max. min, peak to peak, amplitude, + overshoot, – overshoot, mean, cycle mean, RMS, cycle RMS, area, cycle area, extinction ratio (ratio, dB, %), and mean optical power. Continuous update of up to four measurements on any combination of waveforms.

Time Measurement Accuracy – (single-shot, typical) < 38 ps @ 4 GS/s (TDS 784C), <80 ps @ 2 GS/s (TDS 754C, TDS 540C), <150 ps @ 1 GS/s (TDS 724C, TDS 520C).

Measurement Statistics – Display minimum and maximum or mean and standard deviation on any displayed single-waveform measurements.

Thresholds – Settable in percentage or voltage.

Gating – Any region of the waveform may be isolated for measurement using vertical bars.

Snapshot – Performs all measurements on any one waveform showing results from one instant in time.

Cursor Measurements – Absolute, Delta: Volts, Time, Frequency, and NTSC IRE and line number (with video trigger option).

Cursor Types – Horizontal bars (volts), vertical bars (time); operated independently or in tracking mode.

WAVEFORM PROCESSING

Waveform Functions – Sin(x)/x or linear interpolation, Average, Envelope

Advanced Waveform Functions (optional on TDS 500C) – FFT, Integration, Differentiation.

Arithmetic Operators – Add, Subtract, Multiply, Divide, Invert.

Autoset – Single-button, automatic setup on selected input signal for vertical, horizontal, and trigger systems. Also automatically normalizes signals to standard masks when used with the mask testing option.

Waveform Limit Testing – Compares incoming or math waveform to a reference waveform's upper and lower limits.

InstaVu™ Acquisition Oscilloscopes

TDS 500C • TDS 700C

Waveform Histograms – Both vertical and horizontal histograms, with periodically updated measurements, allow statistical distributions to be analyzed over any region of the signal.

Mask Testing (Optional) – In addition to the standard communication masks in the instrument, the masks can be edited on the screen. Together with automatic waveform scaling, the mask tests give rapid verification of a digital bit stream's conformance to pulse templates and eye pattern masks. For optical conformance testing, the internal Fibre Channel and SONET/SDH optical reference receiver filters provide convenient test setup which is compliant to industry standards.

ZOOM CHARACTERISTICS

The zoom feature allows waveforms to be expanded or compressed in both vertical and horizontal axes. Allows precise comparison and study of fine waveform detail without affecting ongoing acquisitions. When used with Hi-res or Average acquisition modes, Zoom provides an effective vertical dynamic range or 1000 divisions or 100 screens.

Dual Window Zoom – Dual graticules simultaneously show selected and zoomed waveforms. Up to two zoom boxes show areas on the selected trace that are being magnified, and the two magnified areas can be overlapped for quick comparison. Color of zoomed trace matches selected trace.

DISPLAY CHARACTERISTICS

Waveform Style – Dots, vectors, variable persistence from 32 ms to 10 s, infinite persistence, and intensified samples.

Color (TDS 784C, TDS 754C, TDS 724C) – Standard palettes and user-definable color for waveforms, text, graticules, and cursors. Measurement text and cursor colors matched to waveform. Waveform collision areas highlighted with different color. Statistical waveform distribution shown with color grading through variable persistence.

Color Grading (TDS 784C, TDS 754C, TDS 724C) – With variable persistence selected, historical timing information is represented by temperature or spectral color scheme providing "z-axis" information about rapidly-changing waveforms.

Gray Scaling (TDS 540C, TDS 520C) – With variable persistence selected, waveform points time-decay through 16 levels of intensity.

Waveform Capture Rate – For 500-point waveforms with infinite persistence mode selected: typically 150 wfms/s (TDS 700C and TDS 500C). With InstaVu™ on: >400,000 wfms/s (TDS 784C, TDS 754C, TDS 540C) and >180,000 wfms/s (TDS 724C and TDS 520C).

Graticules – Full, grid, cross-hair, frame, and NTSC and PAL (with video trigger option).

Format – YT and XY.

Fit to Screen – Entire acquisition memory displayed on screen.

Type – 7 in. diagonal, NuColor™ liquid crystal full color shutter display, 256 color levels (TDS 700C); 7 in. diagonal, magnetic deflection, horizontal raster-scan monitor with P4 white phosphor.

Resolution – 640 horizontal by 480 vertical displayed pixels (VGA).

COMPUTER INTERFACE

GPIB (IEEE-488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARDCOPY

Printer – HP Thinkjet, Deskjet, Laserjet, Epson, Interleaf, PostScript, TIFF, PCX, BMP, DPU411/412, RLE.

Plotter – HPGL.

Data – MathCad, spreadsheet formats.

Interface – GPIB standard.

Hardcopy Interface (optional on TDS 500C) – Centronics and RS-232 (talk only).

STORAGE

Non-volatile Waveform Storage – 4 full 50 K records (Opt. 1M or 2M: 4 full 130 K records, 2 full 250 K records, or 1 compressed 500 K record) (TDS 784C, TDS 754C, TDS 540C); 2 full 50 K records (Opt. 1M or 2M: 2 full 130 K records or 1 full 250 K record) (TDS 724C, TDS 520C).

Non-volatile storage for setups – 10 front panel setups.

Floppy Disk Drive – Store reference waveforms, setups, and image files on 3.5 in. 1.44 MB or 720 K DOS-format floppy disk.

Hard Disk Drive – Store reference waveforms, setups, and image files on internal ≥170 MB hard disk.

POWER REQUIREMENTS

Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 45 to 440 Hz.

Power Consumption – 300 W max.

ENVIRONMENTAL AND SAFETY

Temperature –
Operating: +4° C to +50° C (floppy not used), +10° C to +50° C (floppy in use).
Nonoperating: –22° C to +60° C.

Humidity –
Operating: To 80% RH at ≤32° C. Derates to 30% RH at +45° C.
Nonoperating: To 90% RH at ≤40° C. Derates to 30% RH at +60° C.

Altitude –
Operating: 15,000 ft. (hard disk not used), 10,000 ft. (hard disk in use).
Nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets or exceeds EN55011 Class A Radiated and Conducted Emissions; EN 50081-1; EN60555-2 Power Harmonics; FCC 47 CFR, Part 15. Subpart B, Class A; Australian EMC Framework; EN 50082-1

Safety – UL 3111-1, CSA-22.2 No. 1010.1

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height with feet	193	7.6
Height without feet	178	7.0
Width with handle	445	17.5
Depth with front cover installed	434	17.1
Weight	**kg**	**lbs.**
Net ≈	14.1	31
Shipping Weight ≈	25.4	56

InstaVu™ Acquisition Oscilloscopes

TDS 500C • TDS 700C

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TDS 784C
InstaVu Acquisition Oscilloscope.

TDS 754C
InstaVu Acquisition Oscilloscope.

TDS 724C
InstaVu Acquisition Oscilloscope.

TDS 540C
InstaVu Acquisition Oscilloscope.

TDS 520C
InstaVu Acquisition Oscilloscope.

INCLUDED ACCESSORIES

Probes – 4 each P6139A passive probes (TDS 754C, TDS 540C), 2 each P6139A (TDS 724C, TDS 520C).

Documentation – Quick Reference in 8 languages (020-2204-00), User Manual (070-9869-00), Technical Reference (070-9874-01), Programmer's Manual (063-2773-00) in MS-Help format on floppy disk, and NIST, MIL-STD-45662A and ISO9000 calibration certificate.

Accessories – Front Cover (200-3696-01), US power cord (161-0230-01), and accessory pouch (016-1268-00; TDS 784C, TDS 754C, TDS 724C).

INSTRUMENT OPTIONS

Opt. 05 – Add video trigger (NTSC, PAL, HDTV, FlexFormat™).

Opt. 1M – Add 130 K/channel memory length (500 K max on TDS 784C, TDS 754C, TDS 540C; 250 K max on TDS 724C, TDS 520C).

Opt. 2M – Add 2M/channel memory length (8 M max on TDS 784C, TDS 754C, TDS 540C; 4 M max on TDS 724C, TDS 520C). Includes internal hard disk drive.

Opt. HD – Internal 170 MB hard disk drive.

Opt. 2C – Communication Signal Analyzer: includes comm triggers and communication mask testing.

Opt. 3C – Short-wavelength (Fibre Channel FC133, FC266, FC513, FC1063) Optical Reference Receiver; includes P6701B and system calibration.

Opt. 4C – Long-wavelength (SONET/SDH OC1/STM0, OC3/STM1, OC12/STM4) Optical Reference Receiver; includes P6703B and system calibration.

Opt. 13 (TDS 540C, TDS520C only) – Add RS-232C and Centronics hardcopy interfaces.

Opt. 2F (TDS 540C, TDS520C only) – Extended waveform math: FFT, integration, and differentiation.

OPTIONAL POWER CORDS

Opt. A1 – European power cord (220 V, 50 Hz).

Opt. A2 – UK power cord (240 V, 50 Hz).

Opt. A3 – Australian power cord (240 V, 50 Hz).

Opt. A4 – North American power cord (240 V, 60 Hz).

Opt. A5 – Swiss power cord (220 V, 50 Hz).

OPTIONAL ACCESSORIES

Opt. 1K – Add K420 scope cart.

Opt. 1R – Rackmount kit.

Opt. 22 (TDS 724C, TDS 520C only) – Add 2 each P6139A probes.

Opt. 23 (TDS 754C, TDS 540C only) – Add 4 each P6243 active probes.

Opt. 24 (TDS 784C only) – Add 4 each P6139A passive probes.

Opt. 26 (TDS 784C only) – Add 4 each P6245 active probes.

Opt. 2D (TDS 724C, TDS 520C only) – Delete 2 each standard probes.

Opt. 4D (TDS 754C, TDS 540C only) – Delete 4 each standard probes.

Opt. 3I/3P – Color printer and cable (220 V/110 V).

Opt. B2 – Hardcopy version of the programmer's manual (070-9876-00).

Opt. L1 – Substitute French user manual (070-9872-00) for English user manual.

Opt. L3 – Substitute German user manual (070-9873-00) for English user manual.

Opt. L5 – Substitute Japanese user manual (070-9870-00) for English user manual.

Opt. L9 – Substitute Korean user manual (070-9871-00) for English user manual.

RECOMMENDED PROBES

ADA400A – Differential Preamplifier.

AM503S – DC/AC Current Measurement System.

AFTDS – Electrical communication differential signal adapter.

AMT75 – 1 GHz electrical communication 75 Ω adapter.

P5100 – 2.5 kV High-voltage probe.

P5205 – High-voltage 100 MHz differential probe.

P5210 – 5.6 kV High-voltage differential probe.

P6139A – 500 MHz passive 10X voltage probe.

P6205 – 750 MHz active voltage probe.

P6243 – 1 GHz active voltage probe.

P6245 – 1.5 GHz active voltage probe.

P6246 – 400 MHz differential probe.

P6247 – 1 GHz differential probe.

P6563A – SMD passive voltage probes.

P6701B – Short-wavelength (500-950 nm) optical-to-electrical converter.

P6703B – Long-wavelength (1100-1700 nm) optical-to-electrical converter.

P6723 – Optical logic probe (1310/1550 nm).

TCP202 – DC to 50 MHz current probe.

RECOMMENDED ACCESSORIES

Also see page 438.

Service Manual – TDS 500C/600B/700C. Order 070-9875-00.

GPIB Cable – 1 meter. Order 012-0991-01.

GPIB Cable – 2 meters. Order 012-0991-00.

RS-232 Cable – Order 012-1298-00.

Centronics Cable – Order 012-1250-00.

Soft-sided Carrying Case – Order 016-0909-01.

Transit Case – Order 016-01135-00.

Scope Cart – Order K420.

SOFTWARE

LVWIN – LabVIEW for PC Windows operating system.

LWCVI – LabWindows for CVI system.

LWDOS – LabWindows for DOS operating system.

S3FT400 – WaveWriter™ AWG and waveform creation software.

TTiP – Telecommunications Templates and i-Pattern™ software.

WSTR31 – WaveStar™ waveform capture and documentation software.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488

Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Real-Time™ Oscilloscopes

TDS 684B • TDS 680B • TDS 644B • TDS 620B • TDS 640A

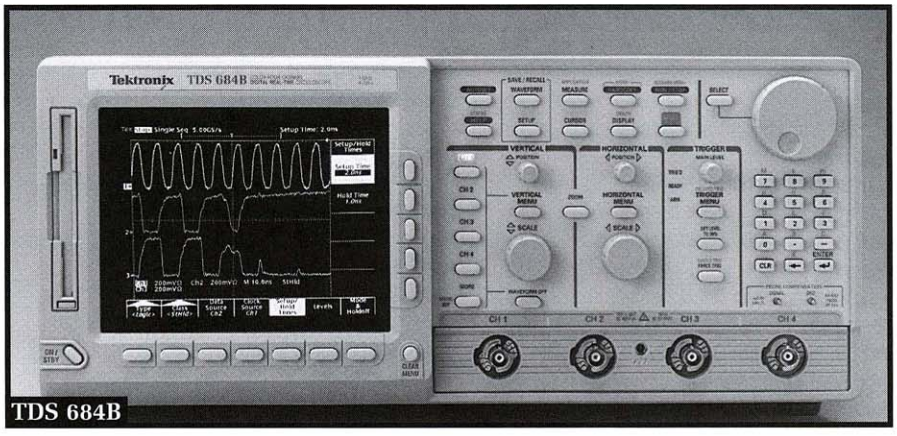
Features

TDS 684B/TDS 680B/ TDS 644B/TDS 620B/TDS 640A

- 1 GHz and 500 MHz Bandwidth
- 5 GS/s and 2.5 GS/s Sample Rates
- 4 and 2 Input Channels
- 8-Bit Vertical Resolution
- Greater than 11-Bits with Averaging
- Record Length to 15,000 Points
- 1 mV/div to 10 V/div Sensitivity
- 1.5% Vertical Accuracy
- Waveform Math and Advanced Waveform DSP
- 1 ns Peak Detect (not available w/TDS640A)
- Channel Deskew (not available w/TDS640A)
- Fully Automated Measurement System
- Waveform Pass/Fail Template Testing
- Color VGA Display
- 3.5 in. DOS Format Floppy Drive
- RS-232, Centronics, GPIB and VGA I/O Ports

Applications

- Digital Design and Debug
- Telecommunications
- Transient Event Capture
- High Energy Physics



TDS 684B

Your designs may be digital but at today's speeds, many of your toughest problems aren't. Crosstalk noise. Transmission effects. Ground bounce. Not to mention sub-nanosecond edges. Today's design problems require high bandwidth oscilloscopes that can measure up to these challenges. The Digital Real-Time™ architecture of the TDS 600 Series simplifies capturing intermittent signals or non-recurring problems like glitches or metastables caused by setup and hold time violations.

TDS 600 Series provides design engineers excellent single shot accuracy for multi-channel, high speed signal characterization. Additional features and specifications of the TDS 600 Series are explained in the TDS Reference section beginning on page 50.

Characteristics

	TDS 640A	TDS 620B	TDS 644B	TDS 680B	TDS 684B
Total Channels	4	2 + 2 aux.	4	2 + 2 aux.	4
Sample Rate (all channels simultaneously)	2 GS/s	2.5 GS/s	2.5 GS/s	5 GS/s	5 GS/s
Real-time Bandwidth	500 MHz	500 MHz	500 MHz	1 GHz	1 GHz
Maximum Record Length per Channel	2,000 pts	15,000 pts	15,000 pts	15,000 pts	15,000 pts
Vertical Resolution	8-Bits; >11-Bits with averaging				
Time Measurement Accuracy	<110 ps @ 2 GS/s	<100 ps @ 2.5 GS/s	<100 ps @ 2.5 GS/s	<50 ps @ 5 GS/s	<50 ps @ 5 GS/s
Advanced Waveform DSP/Math	Std.	Std.	Std.	Std.	Std.
Standard Probes	4 P6139A	2 P6139A	4 P6243	None	None
Display Type	7 in. mono	7 in. mono	7 in. color	7 in. mono	7 in. color
Disk Drive	Std.	Std.	Std.	Std.	Std.
GPIB Port	Std.	Std.	Std.	Std.	Std.
RS-232 & Centronics	Std.	Std.	Std.	Std.	Std.
VGA I/O Port Printer Ports	Std. Mono	Std. Mono	Std. Color	Std. Mono	Std. Color

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digital Real-Time™ Oscilloscopes

TDS 684B • TDS 680B • TDS 644B • TDS 620B • TDS 640A

TIME BASE SYSTEM
Time Bases – Main and Delayed.

Time/div Range – 200 ps/div to 10 s/div. Except TDS 640A: 500 ps/div to 5 s/div.

Time Base Accuracy – Over Any Interval >1ms ±100 ppm.

Record Length per Channel – 500 to 15,000 pts. Except TDS 640A: 500 to 2,000 pts.

Pre-Trigger Position – 0% to 100% of Record.

VERTICAL SYSTEM
Vertical Resolution – 8-Bits (>11-Bits with averaging).

Vertical Sensitivity – 1 mV/div to 10 V/div.

Maximum Input Voltage – 300 V CAT II ±400 V peak. Derate at 20 dB/decade above 1 MHz.

DC Gain Accuracy – 1.5%

Position Range – ±5 divs.

Offset – Primary channels: ±1 V from 1 to 99.5 mV/div, ±10 V from 100 mV to 995 mV/div, ±100 V from 1 V to 10 V/div. Aux. 1, Aux. 2 (TDS 620B, TDS 680B only): same as primary channels.

Bandwidth Selections – 20 MHz, 250 MHz, and Full.

Input Impedance Selections – 1 MΩ in parallel with 10 pF, or 50 Ω (AC and DC coupling).

Input Coupling – AC, DC or GND.

AC Coupled Low Frequency Limit – <10 Hz when AC , 1 MΩ coupled. <200 kHz when AC, 50 Ω coupled.

Channel Isolation – >100:1 at 100 MHz and >30:1 at BW for any two channels having equal V/div settings.

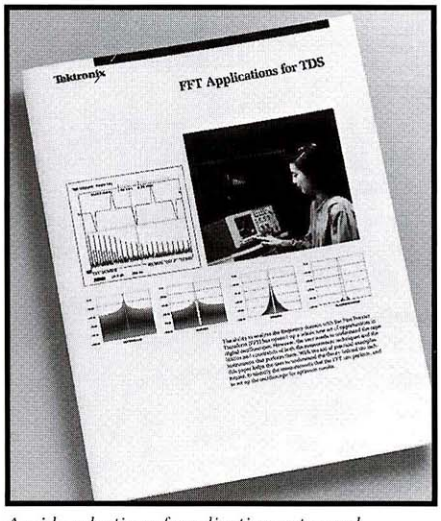
ACQUISITION MODES
Peak Detect (TDS 620B, TDS 644B: 1 ns; TDS 680B, TDS 684B: <1 ns), Sample, Single Sequence, Envelope, Average.

TRIGGERING SYSTEM
Triggers – Edge (main and delayed); Pulse (Width, Glitch, Runt, Slew Rate*1, Time Out); Logic (Pattern, State, and Setup & Hold Time Violation*1); HDTV Video (optional).

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delay by time, events, or events and time.

Delay by Time Range – 16 ns to 250 s. Except TDS 640A: 16 ns to 250 s for t/div setting <10 µs; 15.1 to 250 s for t/div setting >25 µs.



A wide selection of application notes and technical briefs have been written to help ease your understanding and use of specific instrument features. Contact your local sales office for details.

Delay by Events Range – 1 to 9,999,999 events.

External Trigger Input – Input Impedance: ≥1.5 kΩ; Max. Input Voltage: ±20 V (DC + peak AC).

DISPLAY
Color CRT Monitor (TDS 644B/684B) – 7 in. diagonal NuColor™ liquid crystal full-color shutter, 256 levels.

Monochrome CRT Monitor (TDS 620B/680B/640A) – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 white phosphor.

MEASUREMENT SYSTEM
Automatic Measurements – 25 (on entire record or gated region).

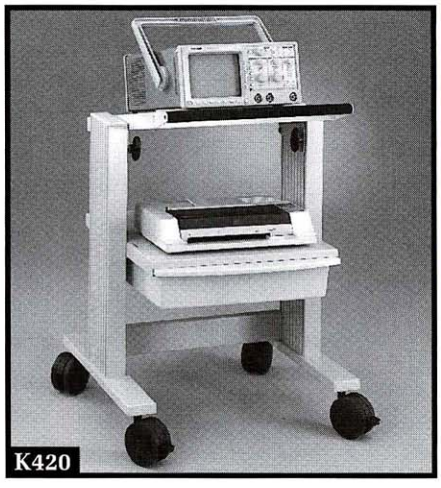
Measurement Accuracy – TDS 680B/684B: <50 ps typical @ 5 GS/s single shot; TDS 620B/644B: <100 ps typical @ 2.5 GS/s single shot.
TDS 640A: <110 ps @ 2 GS/s single shot.

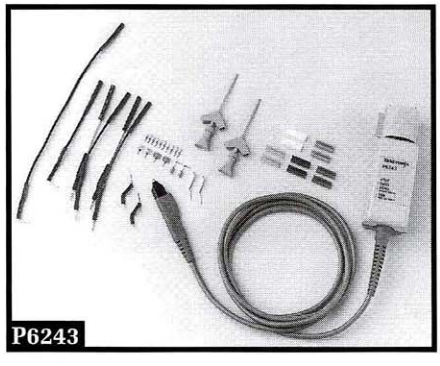
Cursors Measurement – Absolute, Delta; volts, time, frequency, NTSC IRE units and line number with Video Trigger Option.

WAVEFORM PROCESSING
Waveform Functions – Interpolation (sin(x)/x or linear), Average, Envelope, Auto Setup.

Advanced Waveform Functions – FFT, Integration, Differentiation, Waveform (math or acquired) Limit Testing.

**1 Not available in TDS 640A.*





Accessories

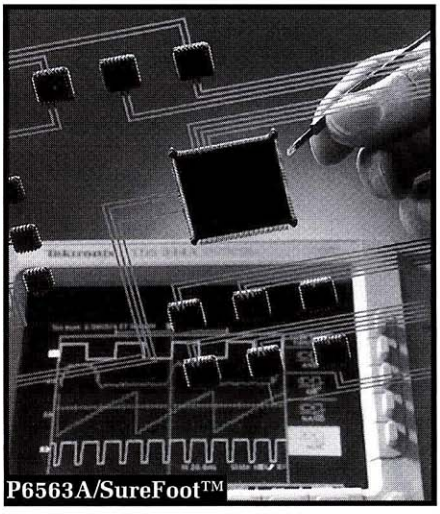
K420 INSTRUMENT CART
- Ergonomic design
- Durable steel and aluminum construction
- Large diameter smooth-rolling casters
- Heavy duty nylon instrument straps
- Simple height, angle and shelf adjustment

P6243
- Standard on the TDS 644B
- Active FET Probes for SMDs
- FET Probe performance at a lower cost
- <1 pF/1 MΩ provides lower circuit loading than conventional passive probes
- Low mass probe head/cable
- Wide bandwidth (DC to 1 GHz)

For complete selection information on all Accessory products, see page 438.

Digital Real-Time™ Oscilloscopes

TDS 684B • TDS 680B • TDS 644B • TDS 620B • TDS 640A


P6563A/SureFoot™

Accessories

P6563A
- Direct Access to SMD Packages
- SMD package support: 50 mil, 25 mil JEDEC, 0.65 mm, 0.5 mm EIAJ
- Low mass probe body and cable system
- DC to 500 MHz bandwidth, 5 pF/9.5 MΩ loading, 20X attenuation

SureFoot®
- Easier Access to SMT Circuitry
- Handheld probing made easier
- No shorting
- No slipping off
- Direct tip connection

P6245
- Active FET Probe for SMDs
- Low DUT loading (≤1 pF/1 MΩ)
- Low mass probe head/cable
- 1.5 GHz bandwidth

For complete selection information on all Accessory products, see page 438.

WaveStar Software (WSTR31)
- Capture Waveforms and Settings from DSOs
- Annotate, Organize and Analyze Data
- Perform Harmonic Analysis up to 51st Harmonic
- Display Table of 22 Measurements
- Store Waveforms, Pictures, Settings, and Notes
- Read TDS Floppies
- Exchange Waveforms and Data with Other Windows™ Application Software
- Restore Waveforms and Settings to DSOs
- Windows® 3.1 Application
- Verified under Windows® 95

For complete information see page 112.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative,inside the U.S. see the price list in the back of this catalog.

TDS 684B
Four-channel Color 1 GHz, 5 GS/s Per Channel Digital Real-Time Oscilloscope.

TDS 680B
Two-channel Monochrome 1 GHz, 5 GS/s Per Channel Digital Real-Time Oscilloscope.

TDS 644B
Four-channel Color 500 MHz, 2.5 GS/s Per Channel Digital Real-Time Oscilloscope.

TDS 640A
Four-channel Monochrome 500 MHz, 2.0 GS/s Per Channel Digital Real-Time Oscilloscope.

TDS 620B
Two-channel Monochrome 500 MHz, 2.5 GS/s Per Channel Digital Real-Time Oscilloscope.

All Include (except where noted):
Four Each P6243 FET Probes (TDS 644B);
Four Each P6139A Passive Probes (TDS 640A);
Two Each P6139A Passive Probes (TDS 620B);
User Manual (070-9383-00);
Quick Reference Guide (070-9382-00)
Programmer's Manual (070-9385-00);
Technical Reference Manual (070-9384-00);
Front Cover (200-3696-00);
North American Power Cord (161-0230-01);
Accessory Pouch (TDS 644B/TDS 684B: 016-1268-00).

Opt. 05 – Video Trigger, NTSC, PAL, HDTV, FlexFormat™.

Opt. 1K – Model K420 Instrument Cart.

Opt. 1R – Rackmount Kit.

Opt. 2D – (TDS 620B only) Delete Standard two P6139A Probes.

Opt. 24 – Add four P6139A 10X Passive Probes.

Opt. 26 – (TDS 684B only) Add four P6245 1.5 GHz, 1pF FET Probes.

Opt. 27 – (TDS 680B only) Add two P6245 1.5 GHz, 1 pF FET Probes.

Opt. 3I – (220 V) Color Printer.

Opt. 3P – (110 V) Color Printer.

Opt. 4D – (TDS 644B only) Delete Standard four P6243 FET Probes.

Opt. 95 – Calibration Data Report.

Opt. 96 – Calibration Certificate.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – UK 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

See General Customer Information Section for additional description.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

SOFTWARE

WSTR31 – WaveStar™ waveform capture and documentation software.

PRODUCT UPGRADES

Disk Drive – 3.5 in., 1.44 MB DOS Format. For TDS 620/620A/620B, TDS 640/640A, TDS 680B. Order TDSXFIF.

RECOMMENDED ACCESORIES

See page 438.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

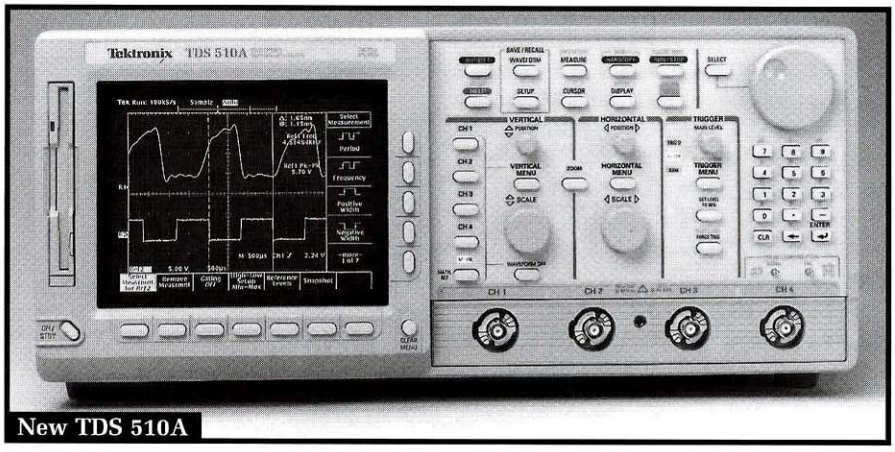
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digitizing Oscilloscope
New TDS 510A

Features

TDS 510A

- 500 MHz Bandwidth
- Sample Rates to 500 MS/s
- 4 Channels
- Width, 2 ns Glitch, Runt, State, and Pattern Triggering
- 1 mV to 10 V/div Sensitivity
- Infinite and Variable Persistence
- 8-Bit Vertical Resolution Up to 12-Bit in Hi-Res Mode
- 1% Vertical Accuracy
- FFT, Integration, Differentiation (option 2F)
- 25 Automatic Measurements
- GPIB Programmable
- 3.5 in. Floppy Disk Drive
- CE Marking



New TDS 510A

TDS 510A Digital Oscilloscope

The TDS 510A Digital Oscilloscope is a full featured, cost effective, versatile oscilloscope which meets the measurement requirements for general purpose research and design. Its industry-preferred graphical user interface makes it easy to learn and efficient to use. The TDS 510A advanced trigger capability allows the user to trigger and view signals in a wide variety of simple as well as complex design and analysis settings. With four channels, 50 K-points per channel record length, and powerful waveform acquisition modes, the TDS 510A can satisfy most complex design, debug, and analysis requirements.

A full complement of graphical and digital output formats provides report generation and documentation of measurement results. These output formats are compatible with popular word-processor and spreadsheet applications. Output interfaces include an integral floppy disk drive, GPIB, RS232C, and Centronics.

The most complete selection of active and passive probes facilitates measuring virtually any voltage or current waveform. Probe types include active and passive voltage probes, differential voltage probes for high and low voltages, and current probes. When used with the TDS 510A, these probes automatically provide correct scaling and engineering-unit readout for voltage, current, and power waveforms. You can tailor the TDS 510A to your specific measurement environment by using the appropriate probes and accessories. This powerful combination makes the TDS 510A the ideal instrument choice for low power, medical electronics, bio-physical, automotive, and general-purpose electronic design and development.

Characteristics

VERTICAL SYSTEM

Bandwidth – 500 MHz.*1

Channels – Four.

Waveform Capture Rate – 150 waveforms/s.

Max Sample Rate –
1 and 2 Channels: 500 MS/s.
4 Channels: 250 Ms/s.

Sensitivity – 1 mV to 10 V/div.

Position Range – ±5 divisions.

Offset –
1 to 99.5 mV/div: ±1 V.
100 to 995 mV/div: ±10 V.
1 to 10 V/div: ±100 V.

DC Gain Accuracy – ±1%.

Vertical Resolution – 8-Bits.

Analog Bandwidth Selections – 20 MHz, 100 MHz, and Full.

Input Coupling – AC, DC, or GND.

Input Impedance Selections –
1 MΩ in parallel with 10 pF, or 50 Ω (AC and DC coupling).

**1 500 MHz typical at probe tip with P6139A probe.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscope
New TDS 510A

Maximum Input Voltage – 300 V CAT II; ±400 V (peak). Derate at 20 dB/decade above 1 MHz. 1 MΩ or GND coupled.

Channel Isolation – >100:1 at 100 MHz; >30:1 at BW for any two channels with equal V/div settings.

AC Coupled LF Limit –
AC 1 MΩ coupled: ≤10 Hz.
AC 50 Ω coupled: ≤200 kHz.

TIME BASE SYSTEM
Time Bases – Main, Delayed.

Time/Div Range – 500 ps to 10 s/div.

Time Base Accuracy – ±25 ppm over any interval ≥1 ms.

Record Length – 50 K points.

Pre-Trigger Position – 0 to 100% of record.

ACQUISITION SYSTEM
Acquisition Modes – Sample, Single Sequence, Average, Envelope, Hi-Res, Peak Detect.

TRIGGER SYSTEM
Trigger Types – Edge (Main and Delayed), Pulse (Width, Glitch, and Runt), Logic (Pattern and State), Video – Opt. 05 (NTSC, PAL, HDTV, FlexFormat™).

Main Trigger Modes – Auto, Normal, Single.

Delay Trigger Modes – Delay by time, events, or events and time.

STORAGE
Waveforms – Four full 50 K point records.

Setups – 10 front-panel setups.

DISPLAY SYSTEM
Monitor – 7 in., 640 x 480, monochrome.

Waveform Style – Dots or vectors, infinite and variable persistence.

Display Formats – YT, XY Zoom, Fit to Screen.

AUTOMATIC MEASUREMENTS

Period	Frequency
High	Low
+Width	–Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+Duty Cycle	–Duty Cycle
+Overshoot	–Overshoot
Propagation Delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Phase	

Advanced Waveform Functions – FFT, Differentiation, Integration (Option 2F), Limit Testing.

Cursor Measurements – Absolute, Delta; volts, time, frequency. NTSC IRE units and line number with video trigger (Option 05).

Waveform Functions – Interpolation (sin(x)/x or linear), Average, Envelope, Autosetup.

OUTPUTS
VGA Out – Monochrome.

RS-232 and Centronics – Opt. 13.

Hardcopy Formats – Epson, Thinkjet, Deskjet, Laserjet, PostScript, TIFF, PCX, BMP, DPU411/412, HPGL, Interleaf.

Power – 90 to 250 V RMS, 45 to 440 Hz, 300 W maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	193	7.6
Width	445	17.5
Depth	432	17.0
Weight	**kg**	**lbs.**
Net	14.1	31

SAFETY CERTIFICATION
UL and CSA-certified.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TDS 510A
Digitizing Oscilloscope
Includes: P6139A probes (4 each), User Manual (070-9701-00), Reference Card (020-9758-00), Technical Reference (070-9706-00), Programmer's Disk*2 (063-2619-00), Front Cover (200-3696-00), U.S. Power Cord (161-0203-01).

OPTIONS
Opt. 1K – Add K420 Cart.
Opt. 1R – Rackmount.
Opt. 2F – Extended Waveform Math (FFT, Integration, Differentiation).
Opt. 05 – Video Trigger.
Opt. 13 – RS-232 and Centronics Interfaces.
Opt. 20 – TCP202 Current Probe.
Opt. 21 – TCP202 Current Probe and P5205 High Voltage Probe.
Opt. B2 – Hardcopy Programmer's Manual.
Opt. L1 – French User Manual.
Opt. L3 – German User Manual.
Opt. L5 – Japanese User Manual.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
See page 438.
Rackmount Kit – 016-1236-00.
Analog Differential Amplifier – ADA400A.
Active FET Probe – P6243.
Programmer's Manual – 070-9702-00.

SOFTWARE SUPPORT
WSTR31 – WaveStar™ Waveform Capture Software.

WARRANTY
Three years. Covers all labor and parts, including CRT. One-year warranty on probes.

**2 Programmer's Disk works as a Microsoft Help file under Windows. The disk allows for printing sections or the complete manual.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Personal Lab Oscilloscopes

New TDS 430A • TDS 460A • TDS 420A

Features

TDS 430A/TDS 420A/TDS 460A

- 200 and 400 MHz Bandwidths
- 100 MS/s Sampling Rate on All Channels
- 30 K Records Standard, 120 K Optional
- 3.5 inch DOS Format Floppy Drive
- 1.5% Accuracy 1 – 10 V/div
- Proprietary Hi-Res Mode for up to 12-Bits of Single Shot Vertical Resolution
- Extended Waveform Math/FFT Optional
- 10 ns Peak Detect Mode for Glitch Capture
- 25 Automatic Measurements
- Pass/Fail (Template) Waveform Testing
- Roll and Triggered Roll Modes
- RS-232 and Centronics Type Interfaces Optional
- Tek Secure®

DIFFERENTIAL MEASUREMENTS

- ADA400A Analog Differential Amplifier (10 µV/div sensitivity)
- P5200/P5205/P5210 High Voltage Differential Probes (up to 5600 V) for Floating Measurements

(Please see pages498 and 500 for details on ADA400A, P5200, P5205 and P5210)

Applications

- Biophysical/Biomedical Research
- Electrophysical and Electromechanical System Design
- Audio System Measurement and Analysis
- Manufacturing Test and Quality Control
- Power Supply and Power-related Design
- Product Service and Maintenance

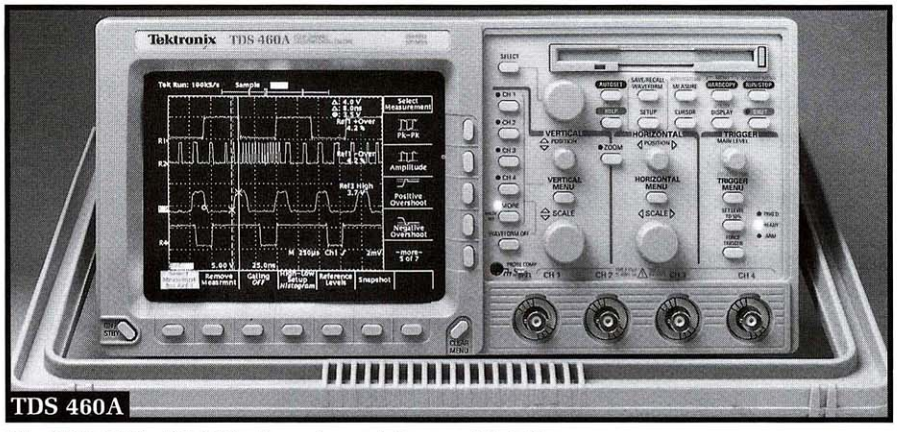
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*



The TDS 460A 400 MHz, four channel, Personal Lab Scope.

TDS 400A Personal Lab Oscilloscopes

For professionals who demand high precision and fidelity from their measurements, the TDS 400A Personal Lab Scopes combine excellent performance and a broad feature set, all at affordable prices. A choice of 2 and 4 channel models ranging from 200 MHz to 400 MHz with 100 MS/s on all channels makes the TDS 400A Series a worthy fit for a variety of demanding applications.

Characteristics

SIGNAL ACQUISITION SYSTEM

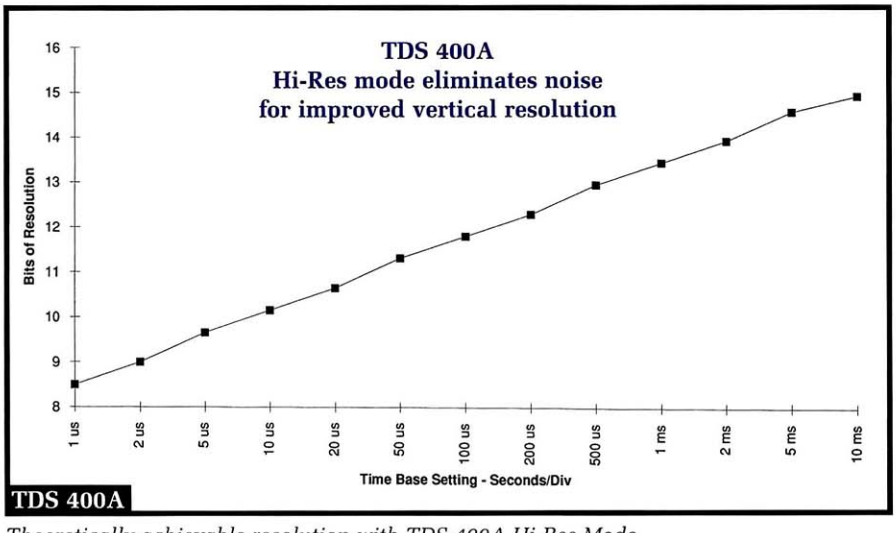
Bandwidth – 200 MHz (TDS 420A), 400 MHz (TDS 430A, TDS 460A).

Channels – 4 (2 on TDS 430A).

Sample Rate – 100 MS/s on all channels.

Sensitivity – 1 mV to 10 V/div (with calibrated fine adjust).

Position Range – ±5 Divisions.



Theoretically achievable resolution with TDS 400A Hi-Res Mode.

Personal Lab Oscilloscopes

New TDS 430A • TDS 460A • TDS 420A

Offset Range – ±1 V from 1 to 99.5 ; ±10 V from 100 mV to 995 ; ±100 V from 1 to 10 V/div.

DC Gain Accuracy – ±1.5%.

Vertical Resolution – 8-Bits (256 levels over 10.24 vertical divisions).

Analog Bandwidth Selections – 20 MHz, 100 MHz, and full.

Input Coupling – AC, DC or GND.

Input Impedance Selections – 1 MΩ in parallel with 15 pF, or 50 Ω (AC and DC coupling).

Maximum Input Voltage – 300 V CAT II ±400 Vpeak. Derate at 20 dB/decade above 1 MHz. 1 MΩ or GND coupled.

Channel Isolation – >100:1 at 100 MHz for any two channels.

AC Coupled Low Frequency Limit – ≤10 Hz when AC 1 MΩ coupled. ≤200 kHz when AC 50 Ω coupled.

ACQUISITION MODES

Peak Detect – High frequency and random glitch capture. Captures glitches of 10 ns using acquisition hardware at all real-time sampling rates.

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions, selectable from 2 to 2000, infinite.

Average – Waveform averages selectable from 2 to 10,000.

Hi-Res – Vertical resolution improvement and noise reduction on low-frequency signals, e.g. 12-Bits at 10 ms/div and slower. Enhanced vertical resolution (>12-Bits) for noise reduction, on low frequency signals. Make precise low-level signal measurements (up to 5 µV) with differential amplifier (ADA400A).

TIME BASE SYSTEM

Time Bases – Main, Delayed.

Time/Division Range – 1 ns to 20 s/div.

Time Base Accuracy – 0.015% over any interval ≥1 ms.

Record Length (real time and equivalent time) – Sample points per channel: 500 to 30,000. Opt. XL offers 120,000 points.

Pre-Trigger Position – Selectable from 0 to 100% of record.

TRIGGERING SYSTEM

Triggers – Main, Delayed.

Main Trigger Modes – Auto, Normal, Single Sequence.

Delayed Trigger – Delayed by time or events.

Time Delay Range – 0 ns to 20 s.

Events Delay Range – 2 to 10,000,000 events.

External Rear Input – >1.5 kΩ; Max input voltage is ±6 V (DC + AC peak).

Video Trigger Types – NTSC, PAL, SECAM, and Custom; TV Field, field 2 or both, Any line within a field. Line Rates –10 kHz to 64 kHz, interlaced, non-interlaced, composite.

Video Trigger Sensitivity – 0.6 divisions of composite SYNC will achieve a stable display.

DISPLAY

Waveform Style – Dots or vectors. Infinite and variable persistence from 250 ms to 10 s.

Gray Scaling – With variable persistence selected, waveform points gradually decay through 16 levels of intensity, providing "z-axis" information about rapidly changing waveforms.

Update Rate – 200 ea. 500 point waveforms per sec with infinite persistence mode selected.

Graticules – Full, grid, cross hair, frame.

Format – YT and XY.

VGA Out – Drives VGA display monitors.

ZOOM

The zoom feature allows waveforms to be expanded, compressed and positioned in both vertical and horizontal axes. Allows precise comparison and study of fine waveform detail without affecting ongoing acquisitions. When used with Hi-Res or Average acquisition modes, Zoom provides an effective vertical dynamic range of 1000 divisions or 100 screens.

MEASUREMENT SYSTEM

Automatic waveform measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+ Duty cycle	– Duty cycle
+ Overshoot	– Overshoot
Propagation delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Phase	

Continuous update of up to four measurements on any combination of waveforms.

Thresholds – Settable in percentage or voltage.

Gated – Any region of the record may be isolated for measurement using vertical bars.

Snapshot – Performs all measurements on any one waveform showing results from one instant in time.

Cursor Measurements – Absolute, Delta, Volts, Time, Frequency.

Cursor Types – Horizontal bars (volts); Vertical bars (time); paired; operated independently or in tracking mode.

WAVEFORM PROCESSING

Waveform Functions – Interpolate-selectable sin(x)/x or linear, Average, Envelope.

Advanced Waveform Functions – FFT, Integration, Differentiation (optional).

Arithmetic Operators – Add, Subtract, Multiply, Invert.

Autosetup – Single button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

Waveform Limit Testing – Compares incoming waveform to a reference waveform's upper and lower limits.

COMPUTER INTERFACE

GPIB (IEEE 488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARDCOPY/DESKTOP PUBLISHING

Printer – HP ThinkJet, Epson, PostScript, Interleaf, DeskJet, LaserJet, TIFF, PCX, BMP (Microsoft Windows).

Plotter – HPGL.

Interface – GPIB standard.

Optional Hardcopy Interface – Centronics Type and RS-232.

Available Printer Pack – 4 in. thermal printer and storage pouch.

STORAGE

Waveforms – 30,000 waveform points of non-volatile storage, 120,000 points optional.

Floppy Drive – 3.5 in. 1.44 MB or 720 KB DOS compatible (store waveforms, screen data, and setups)*1

Setups – 10 front-panel setups.

CRT

Type – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P31 green phosphor.

Resolution – 640 horizontal by 480 vertical displayed pixels.

**1 Waveforms can be stored to file in MathCAD and Spreadsheet (Excel, Lotus 1-2-3) formats for analysis.*

Personal Lab Oscilloscopes

New TDS 430A • TDS 460A • TDS 420A

POWER REQUIREMENTS

Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 48 to 63 Hz.

Power Consumption – 240 W max.

**1 Waveforms can be stored to file, in MathCAD and spreadsheet (Excel, Lotus 1-2-3) format for analysis.*

ENVIRONMENTAL AND SAFETY

Temperature – Operating: 0°C to +50°C. Nonoperating: –40°C to +75°C.

Humidity – Operating and nonoperating: Up to 95% relative humidity at or below +40°C; to 75% relative humidity from +41°C to +50°C.

Altitude – Operating: 15,000 ft., nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve # 1, RE-02, Part 7; meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart J, Class A.

Safety – Listed UL 3111-1, certified to CAN/CSA – C22.2 No. 1010.1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	164	6.4
w/acc. pouch	177	7.5
Width	362	14.25
Depth		
w/front cover installed	491	19.25
w/handle extended	576	22.2
Weight	**kg**	**lbs.**
Net ≈	9.1	22.5
Shipping ≈	12.5	32

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TDS 430A
Two-Channel, 400 MHz Digitizing Oscilloscope.

TDS 420A
Four-Channel, 200 MHz Digitizing Oscilloscope.

TDS 460A
Four-Channel, 400 MHz Digitizing Oscilloscope.
All include: 1 Probe Per Channel (P6138A 10X Passive Probes); Video Trigger; Reference Manual (070-8035-03); User Manual (070-8034-03); Performance Verification Document (070-8721-02); U.S. Power Cord (161-0230-01).

INSTRUMENT OPTIONS

Opt. XL – 120,000 Point Record Length; RS-232 and Centronics Hardcopy Interfaces; Extended Waveform Math: FFT; Integration, Differentiation; Front Cover and Accessories Pouch.

Opt. 1R – Rack Mount.

Opt. 95 – NIST, MIL-STD-45662A and ISO 9000 Calibration Data Report.

Opt. J2 – 2 year Post Warranty Repair.

Opt. J5 – 5 year Calibration Services.

PROBES

See page 438.

Differential Probes –
400 MHz, 30 dB CMRR. Order P6246.

High Voltage Probes –
2.5 kV, 25 MHz, 2.75 pF/10M, 100X. Order P5100.
20 kV, 75 MHz, 3pF/100M, 1000X, 3.1 m. Order P6015A.

High Voltage Differential Probe –
Up to 1300 V, 25 MHz. Order P5200.
Up to 1300 V, 100 MHz. Order P5205.

Passive Probe 1x – Order P6101B.

Passive Probe – 10X. Order P6138A.

FET Probe – Order P6205.

SMT Probe – Order P6562A.

TTL Logic Probe – Order P6408.

Optical Converters –
500nm to 950nm. Order P6701B.
1100 nm to 1700nm. Order P6703B.

DC/AC Current Probe System – Order AM 503S.

RECOMMENDED ACCESSORIES –

Also see page 438.

Analog Differential Amplifier –
10 µV sensitivity. Order ADA400A.

Current Measurement Capability –
Order TDS 400A and AM 503S.

Scope Cart – Order K212.

Rackmount Kit – Order 016-1166-00.

Soft-sided Carrying Case – Order 016-1158-01.

Transit Case – Order 016-1157-00.

Printer – Order HC411 Thermal Printer.

Optional Printer Pack – 4 in. thermal printer and storage pouch. Order TDS4F5P.

Programmer's Manual – Order 070-9876-00.

Video Clamp – Order 013-0278-00.

SOFTWARE SUPPORT

LabWindows® – Order S3FG910.

WSTR31 – WaveStar™ waveform capture and documentation software.

CABLES

GPIB – 1 meter. Order 012-0991-01.
2 meters. Order 012-0991-00.

Service Manual.

INTERNATIONAL POWER OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – UK 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.
International power options required on instruments and selected accessories for operation outside U.S. For operation outside U.S., specify A1-A5 power options.
See General Customer Information Section for description.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Personal Lab Scope Solutions

ADA400A • P5200 • AM 503S

Features

ADA400A DIFFERENTIAL PREAMPLIFIER

- 10 µV Sensitivity (with 12-Bits Resolution in Hi-Res Mode)
- Input R = 1 MΩ or Selectable for ∞
- CMRR: DC – 10 kHz, 100 dB (100,000:1); 100 kHz: 90 dB (31,000:1)

P5200 FLOATING MEASUREMENTS

- Maximum Differential Input Voltage: 1300 V
- Input R = 4 MΩ Each Input
- CMRR: DC: 60 dB (1,000:1); 1 MHz: 40 dB (100:1)
- Safety: UL 1244, CSA C22.2, IEC 1010
- No More Floating Your Scope
- Safe for User and DUT

AM 503S CURRENT MEASUREMENT SYSTEM

- DC to 50 MHz (20 A Continuous/100 A Peak) with A6302 Probe
- DC to 15 MHz (100 A Continuous/500 A Peak) with A6303 Probe
- DC to 2 MHz (500 A Continuous) with A6304XL Probe

Applications

BIOPHYSICAL/BIOMEDICAL
ADA400A Differential Preamplifier

- Medical/Biophysical Research
- Mechanical Analysis
- Medical Equipment Design
- Audio Design

DIFFERENTIAL INPUT
P5200 High Voltage Floating Measurements

- Switching Power Supply Design
- Control System Design
- Electric Vehicle Design
- Motor Drive Design

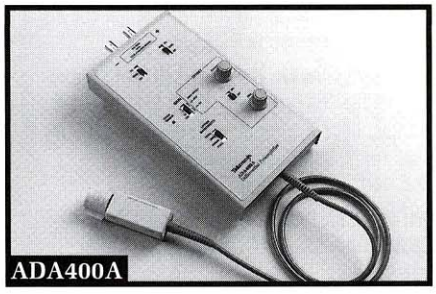
CURRENT MEASUREMENT SYSTEMS

- Broad Range of Current Measurements
- AC/DC Current

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

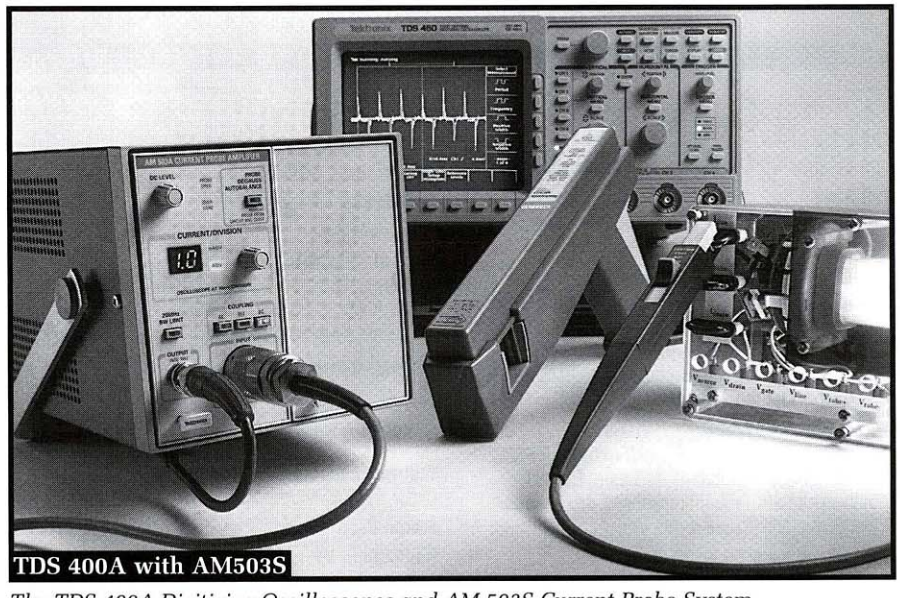
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.



The TDS 400A and ADA400A Analog Differential Amplifier enable microvolt signal measurements (10 µV/div sensitivity) in noisy environments. This combination is well suited for bioscience and mechanical research applications. (See page 498 for details.)

The TDS 400A and P5200 high voltage differential probe combination ensures safe floating measurements up to 1300 V. This combination eliminates the dangerous practice of floating an oscilloscope when making certain high voltage measurements. (See page 500 for details.)



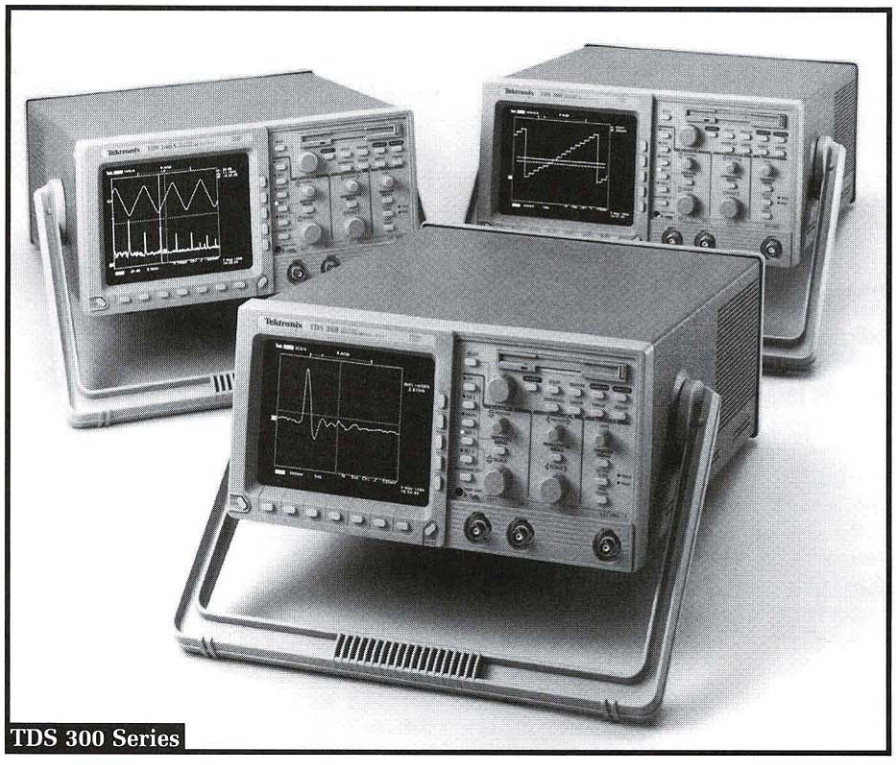
The TDS 400A Digitizing Oscilloscopes and AM 503S Current Probe System. The AM 503S and TDS 400A combination are well suited for measuring currents in switching supplies.

Digital Real-Time™ Oscilloscopes

TDS 340A • TDS 360 • TDS 380

Features

- 100 MHz, 200 MHz, 400 MHz Bandwidths
- 500 MS/s, 1 GS/s, 2 GS/s Sampling Rates
- Two Input Channels
- Built-In 3.5 in. Floppy Disk Drive
- 2 mV/div to 10 V/div
- AutoSetup
- Accumulate Display Modes
- 2% Vertical Accuracy
- 1 K Record Length
- Roll Mode
- 21 Automatic Measurements
- FFT Analysis
- 10 ns Peak Detect for High-speed Glitch Capture
- Option 14 for GPIB, RS-232-C Programmability, Parallel Printer Interface, & VGA Monitor Output



TDS 300 Series

Tektronix Digital Real-Time

With the TDS 300 Series, Tektronix redefines the low-cost digital oscilloscope. No other digital scope offers as much bandwidth and sample rate for the price. By simultaneously sampling at up to five times their bandwidth on both channels, the TDS 300 Series assures you of true acquisitions, minimizing aliasing or other digital sampling effects. Unlike other DSOs, the TDS 300 Series easily gathers enough samples to display waveforms accurately at their full bandwidth. These are the only scopes in their class to reliably acquire high speed transient or single-shot events to their full bandwidth.

Many low-cost DSOs offer only dot displays, which can be hard to interpret, especially for those accustomed to analog oscilloscopes. The TDS 300 Series has Dot, Dot Accumulate, Vector, and Vector Accumulate displays. The Accumulate display modes gather multiple waveforms for a user-defined time (500 ms to ∞), after which the screen is erased. Vector Accumulate mode uses bright vectors to superimpose the current acquisition over the accumulated waveforms. The display is erased at the user-defined time or when the acquisition setting is changed. These modes are useful for doing worst case analysis or signal monitoring. Long term monitoring is easily accomplished by setting the erase time to infinity.

OVERSAMPLING MINIMIZES ALIASING

All of the TDS 300 scopes sample at five times their bandwidth, assuring users of accurate real-time acquisition up to the full bandwidth of the scope, even for single-shot events. This is well beyond the theoretical two samples per period necessary for a DSO to acquire a true signal. If a DSO cannot sample at least twice as fast as the highest frequency component, aliasing occurs and the scope displays a waveform with a lower frequency than that of the actual input signal. The TDS 300 Series' high degree of oversampling not only minimizes aliasing, it also provides a higher resolution waveform.

ACQUISITION POWER

With edge triggering and basic video triggering as standard features, the TDS 300 Series can capture the waveforms that designers and service technicians must see.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digital Real-Time™ Oscilloscopes

TDS 340A • TDS 360 • TDS 380

In addition to 21 automatic waveform measurements, these scopes have four acquisition modes. *Sample* mode provides real-time sampling at the highest throughput rate. At slower sweep speeds, *Peak Detect* indicates if there is higher frequency information buried in a waveform, warning the user to increase the sweep speed to avoid aliasing. *Envelope* mode, by including the highest and lowest points over many acquisitions, shows variations in the signal over time. From several acquisitions, *Average* mode calculates an average value for each waveform point, reducing apparent noise in repetitive signals.

ANALOG SIMPLICITY, DIGITAL PRODUCTIVITY
By balancing the use of on-screen menus with dedicated buttons and knobs, the user-friendly TDS interface retains traditional analog simplicity yet gives quick access to the wide range of digital functions. Frequently used functions, like position and trigger level, are controlled directly with buttons and knobs; secondary functions are menu-driven, eliminating the profusion of buttons found on most low-cost scopes.

The modern graphical user interface dramatically reduces learning time, appealing to users regardless of their digital scope experience. The interface simplifies scope operation without limiting the instrument's capabilities.

3.5 IN. FLOPPY DISK DRIVE
All three models include a 3.5 inch, DOS-compatible floppy disk drive. Simply save screen images or data to disk, then insert the disk into your PC for importing to desktop publishing or spread sheet programs.

ADVANCED MATH SIGNAL PROCESSING/FFT
Waveform functions are extended through the addition of "live" FFT analysis of waveforms. This added function makes the TDS 300 Series ideal for research and analysis applications, such as power supply design and mechanical analysis where power line harmonic distortion and resonance are critical measurements.

COMMUNICATIONS AND PRINTING
Option 14, the communications option, includes GPIB and RS-232-C interfaces, VGA monitor output, and a Centronics-type parallel printer port. With this option one can control the scope from a remote computer for automated testing or waveform and measurement data exchange.

Interleaf (.img), TIF, PCX, BMP, and EPS file formats allow screen captures to be placed directly into desktop published documents. Or, at the push of a button, the scope display can be output directly to a variety of compatible printers.

For service, education, and design work, the TDS 300 Series is without peer among low-cost DSOs.

WAVESTAR™ SOFTWARE
WaveStar software is a new Windows 3.1 application (operation verified under Windows 95) that allows the user to quickly create an electronic lab notebook within their PC. With it, scientists, engineers, or technicians can record measurements made with any TDS 300 Series, Opt. 14 DSO, along with all related screen shots, scope settings, and notes. WaveStar software also provides a simple link to current spreadsheet and documentation software, enabling the user to analyze measurements and incorporate them in reports and other documents. WaveStar software replaces the DOS-based DocuWave® (S60DWAV) software. An upgrade from DocuWave software to WaveStar software is available, subject to the minimum system requirements associated with WaveStar software.

System/Hardware Requirements – IBM-compatible PC 386 (486 or higher recommended), 4 MB RAM, 5 MB of free hard disk space, Microsoft Windows 3.1, one 3.5 in. high-density disk drive, graphics adapter capable of VGA resolution, Opt. 14 for scope, and National Instruments GPIB interface card (IEEE Std 488.2; Version C.12 or later) with GPIB cable, or one RS-232 COM port with RS-232 cable.

Windows Clipboard – Copy/paste through the Windows Clipboard to other Windows applications as bit maps or Windows metafiles.

Waveform Export Format – Excel 4.0 compatible.

Printer/Plotter Support – Uses standard Windows printer drivers supplied by printer vendor.

Characteristics

SIGNAL ACQUISITION SYSTEM
Bandwidth –
TDS 340A: 100 MHz.
TDS 360: 200 MHz.
TDS 380: 400 MHz.

Sample Rate –
TDS 340A: 500 MS/s on each channel.
TDS 360: 1 GS/s on each channel.
TDS 380: 2 GS/s on each channel.

Channels – Two identical channels, each with invert function.

Sensitivity – 2 mV to 10 V/div (with calibrated fine adjust).

Position Range – ±5 divisions.

Calibrated Offset Ranges –

Volts/Div Setting	Offset Range
2 – 99.5 mV/div	±1 V
100 – 995 mV/div	±10 V
1 – 10 V/div	±100 V

DC Gain Accuracy – ±2%.

Vertical Resolution – 8-Bits (256 levels over 10.24 vertical divisions).

ACQUISITION MODES
Sample, Envelope, Average

Peak Detect – High frequency and random glitch capture; Captures glitches as narrow as 10 ns using acquisition hardware at all time/div settings between 25 µs/div and 5 s/div (inclusive).

TIME BASE SYSTEM (MAIN AND DELAYED)
Time/Division Range –
TDS 340A: 5 ns to 5 s/div.
TDS 360: 2.5 ns to 5 s/div.
TDS 380: 1 ns to 5 s/div.

Record Length – 1000 sample points per channel.

Horizontal Accuracy – ± 0.01%.

Roll Mode – 0.1 s/div and slower when Auto Trigger Mode is selected.

TRIGGERING SYSTEM (MAIN ONLY)
Trigger Types – Edge, Video.

Trigger Modes – Auto, Normal.

Trigger Inputs – CH1, CH2, Line, External.

Digital Real-Time™ Oscilloscopes

TDS 340A • TDS 360 • TDS 380

Video-Type Trigger Formats and Field Rates – Triggers on Field 1, Field 2, Any Field (noninterlaced systems), or Lines; from Sync-negative composite video. Triggers on broadcast standard NTSC, PAL, or SECAM video and other interlaced and noninterlaced video with horizontal line rates from 15 to 65 kHz (in 5 ranges) and field rates from 50 to 60 Hz.

DISPLAY

Sin(x)/x Interpolation.

Vector – Connects sample points to display a continuous waveform.

Dots – Displays sample points only.

Vector Accumulate Mode – Accumulates waveform points over a pre-set period of time (500 ms to ∞) and superimposes the current waveform with bright vectors.

Dot Accumulate Mode – Accumulates waveform points over a pre-set period of time (500 ms to ∞).

Format – YT and XY.

AUTOMATIC MEASUREMENTS

Period
Frequency
+Width
–Width
Rise Time
Fall Time
+Duty Cycle
–Duty Cycle
+Overshoot
–Overshoot
High
Low
Max
Min
Pk–Pk
Amplitude
Mean
Cycle Mean
RMS
Cycle RMS
Burst Width.

CURSORS

Types – Horizontal bars, vertical bars, paired (volts @ time).

Measurements – Absolute volts, Δ volts, time, and frequency.

PHYSICAL CHARACTERISTICS

	Portable		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width w/ handle	362	14.3	483	19
Height w/ pouch	191	7.5		
w/o pouch	165	6.5	178	7
Depth (stand alone)	472	18.6	472	18.6
w/ front cover	490	19.3		
w/ handle(s)	564	22.2	518	20.4
Weight	**kg**	**lbs.**	**kg**	**lbs.**
TDS 300	6.9	15.5		
Domestic Shipping	13.1	29	14.4*1	32*1

*1 *Weight of conversion kit only.*

WAVEFORM PROCESSING

Arithmetic Operators – Add, subtract, multiply.

AutoSetup – Single button automatic setup on selected input signal for vertical, horizontal, and trigger systems.

FFT Analysis – A mixed radix FFT routine is applied to the time domain waveforms to analyze frequency content. A Hanning Window is always applied to the acquired signal. The display uses dBV_{RMS} vertical scaling.

NON-VOLATILE STORAGE

Waveforms – Two 1000 point reference waveforms.

Setups – 10 front panel setups.

Floppy Drive – 3.5 in., 1.44 MB or 720 K DOS-compatible; PC formats: .BMP, .TIF, .PCX, .EPS; spreadsheet formats: Excel, Lotus123, and MathCAD for mathematical modeling and analysis.

OPTION 14: I/O INTERFACE

GPIB (IEEE-488.2) Programmability – Full talk/listen modes; Control of all modes, settings, and measurements.

RS-232-C Interface Programmability – Full talk/listen modes; Control of all modes, settings, and measurements. Baud Rate up to 38,400. 9-Pin, DTE.

VGA – Monitor output for direct display on large VGA-equipped monitors.

Hardcopy Port – Centronics-type parallel, RS-232-C, or GPIB.

DC Power for Printer

Programmer Manual – (070-9442-00).

HARD COPY CAPABILITY

Graphics File Formats – Interleaf (.img), TIF, PCX (PC Paintbrush), BMP (Microsoft Windows), and Encapsulated PostScript (EPS).

Printer Formats – Thinkjet, Deskjet, Laserjet, Epson (9- & 24-Pin), Seiko DPU 411/II, DPU 412.

MECHANICAL

Cooling Method – Forced air circulation with no air filter.

ENVIRONMENTAL AND SAFETY

Temperature –
–10° to +55° C (operating);
–51° C to +71° C (nonoperating).

Humidity –
Up to 95% RH at or below +40° C;
up to 75% RH from 41° C to 55° C
(operating and nonoperating).

Altitude –
To 15,000 ft/4,570 m (operating);
to 40,000 ft/12,190 m (nonoperating).

Electromagnetic Emissions –
Meets EN50081-1; VFG 0243; FCC Rules and Regs, 47 CFR, Part 15, Subpart B, Class A.

Safety – UL 3111-1 Listed, EN61010 Certified CAN/CSA C-22.2 No. 1010.1-92.

Digital Real-Time™ Oscilloscopes

TDS 340A • TDS 360 • TDS 380

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TDS 340A/TDS 360/TDS 380
Digital Real-Time™ Oscilloscopes
Includes: Two each P6109B 10X Passive Probes (TDS 340A), Two each P6111B 10X Passive Probes (TDS 360), Two each P6114B 10X Passive Probes (TDS 380), User Manual (070-9459-00), Reference (070-9434-00), U.S. Power Cord (161-0230-01), NIST Certificate of Traceable Calibration.

MEASUREMENT SERVICE OPTIONS
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

RECOMMENDED ACCESSORIES
Also see page 438.

Cart – K212.

Printer – HC411 Thermal Printer.

TDS4F5P Printer Pack – with Thermal Printer.

Soft-Sided Carrying Case – Order 016-1158-01.

Deluxe Transit Case – w/ Retractable Wheels/Handle. Order 016-1157-00.

Carrying Case – Order 016-0792-01.

Front Cover – Order 200-3232-01.

Accessories Pouch – Order 016-1159-00.

Rackmount Kit – Order 016-1166-00.

Opt. 14 – TD3F14A Field Upgrade Kit.

INSTRUMENT OPTIONS
Opt. 14 – I/O Interface.

SOFTWARE
WSTR31 – WaveStar™ Software for Windows 3.1.

WSTR31U – Upgrade of DocuWave® Software to WSTR31.

PROBES
P5100 – 100X High Voltage Passive Probe.

P5200 – High Voltage Differential Probe.

P6101B – 1X Passive Voltage Probe (15 MHz).

P6109B – 10X Passive Voltage Probe (100 MHz).

P6111B – 10X Passive Voltage Probe (200 MHz).

P6114B – 10X Passive Voltage Probe (400 MHz).

P6129B – 1X/10X Switchable Passive Voltage Probe (100 MHz).

P6243S – Active FET Probing System (1 GHz).

P6408 – Word Recognizer/Trigger Probe.

AM503S – DC/AC 100 MHz Current Probe System.

P6561A – SMD Small Geometry Probe.

ACCESSORY CABLES
GPIB, 1 m (3.3 ft.) – Order 012-0991-01.

GPIB, 2 m (6.6 ft.) – Order 012-0991-00.

RS-232 – 9-Pin female to 9-Pin female connectors, null modem, 76 inch (for AT style computers) Order 012-1379-00, 9-Pin female to 25-Pin female connectors, null modem, 76 in. (for PC style computers) (012-1380-00), 9-Pin female to 25-Pin male connectors, null modem, 9 ft. (for serial interface printers) (012-1298-00), 9-Pin female to 25-Pin male connectors, 15 ft. (for modems) (012-1241-00).

Centronics – 25-Pin male to 36-Pin Centronics, 2.4 meter (8 ft.) (for parallel printer interfaces) (012-1214-00).

NEC®VGA video cable*[1] – Order 73893029.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australia 240 V, 50 Hz.

Opt. A4 – North America 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

INTERNATIONAL USER MANUALS
Opt. STD – English (070-9459-00).

Opt. L1 – French (070-9431-00).

Opt. L3 – German (070-9432-00).

Opt. L4 – Spanish (070-9433-00).

Opt. L5 – Japanese (070-9440-00).

Opt. L7 – Simple Chinese (070-9437-00).

Opt. L8 – Traditional Chinese (070-9438-00).

Opt. L9 – Korean (070-9439-00).

REFERENCE MANUAL
English (070-9434-00).

Simple Chinese (070-9441-00).

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

WARRANTY INFORMATION
Three year warranty covering all labor and parts, excluding probes

[1] Use an appropriate adapter when other than a 9-Pin monitor connection is needed. Not available from Tektronix.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digital Real-Time™ Oscilloscopes

TDS 210 • TDS 220

Features

- 60 MHz or 100 MHz
- 1 GS/s Sample Rate
- Dual Time Base
- Autoset
- Waveform and Setup Memories
- Automatic Measurements
- Multi-Language User Interface
- Compact, Lightweight

TDS2HM HARDCOPY EXTENSION MODULE (OPTIONAL)

- Centronics Parallel Port

TDS2CM COMMUNICATIONS EXTENSION MODULE (OPTIONAL)

- Centronics Parallel Port
- RS-232 Port
- GPIB Port

TDS2MM MEASUREMENT EXTENSION MODULE (OPTIONAL)

- FFT
- Rise Time/Fall Time
- Negative/Positive Pulse Width
- Centronics Parallel Port
- RS-232 Port
- GPIB Port

Test & Measurement World BEST IN TEST 1997 AWARD WINNER

ELECTRONIC PRODUCTS 1996 PRODUCT OF THE YEAR AWARD

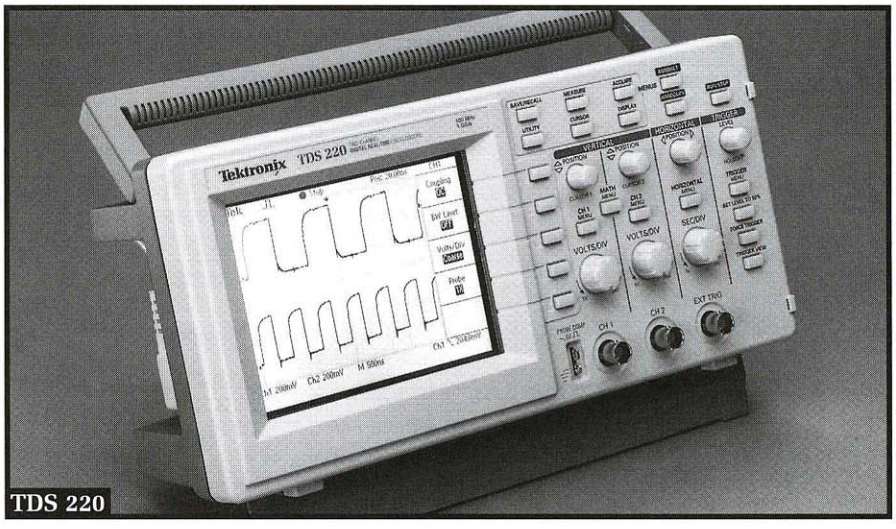
Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.



TDS 220

Digital Technology at an Analog Price

Tektronix, the worldwide leader in oscilloscope technology, offers breakthrough Digital Real-Time advantages at low-cost analog oscilloscope prices. The 60 MHz TDS 210 and 100 MHz TDS 220 Digital Real-Time Oscilloscopes are an unbeatable value for performance, reliability, and affordability. Fast, error free measurements, low cost, and a familiar user interface encourage analog users to move to digital oscilloscopes.

DIGITAL REAL-TIME PERFORMANCE

No other digital oscilloscope offers as much bandwidth and sample rate for the price. By sampling at 16 and 10 times their bandwidths on both channels, the TDS 200 Series oscilloscopes provide accurate real-time acquisition up to their full bandwidth.

Digital storage technology supports features not available on analog oscilloscopes, including automatic measurements, peak detect, storage of two reference waveforms and five instrument setups, and autoset. Peak detect and high sample rates minimize aliasing while capturing waveform details that remain unseen on analog oscilloscopes.

EXTENSION MODULES

Three useful modules are available with capabilities not possible on analog oscilloscopes. The Hardcopy Extension Module allows printing of screen shots via a Centronics-type parallel port. The Communications Extension Module provides the same printer port plus RS-232 and GPIB programmability. The Measurement Extension Module combines the features of the Communication Module plus Fast Fourier Transform (FFT) analysis and four additional automatic measurements.

EASY TO USE

The user interface is similar to that of an analog oscilloscope, but with improvements that reduce learning time and increase efficiency. Knobs and buttons are grouped by function and provide direct access to controls. Readouts or menus are displayed on-screen at all times, allowing users to more quickly and accurately determine instrument settings. The display responds quickly to control adjustments and has a fast update rate.

The reliable, backlit liquid crystal display permits the instrument to be only 4.75 inches (11 cm) from front to back, while lightweight, rugged construction allows for portability. A built-in security loop helps prevent theft.

Both models have a multi-language user interface. Menus and help text are provided in a user-selectable language: English, Spanish, French, German, Italian, Portuguese, Korean, Japanese, Traditional Chinese, or Simplified Chinese.

FROM ANALOG TO DIGITAL

The TDS 210 and TDS 220 oscilloscopes are designed for people who need the low cost and facility of analog oscilloscopes but want the capabilities made possible by digital technology. If an inexpensive yet high performance oscilloscope is needed for the production line, bench, or training lab for users who are considering changing from analog to digital, a TDS 200 Series Digital Real-Time Oscilloscope is the best choice.

Digital Real-Time™ Oscilloscopes
TDS 210 • TDS 220

Characteristics

SIGNAL ACQUISITION SYSTEM
Bandwidth –
TDS 210: 60 MHz
TDS 220: 100 MHz

Sample Rate –
1 GS/s on each channel

Channels –
2 identical channels plus external trigger

Sensitivity (with calibrated fine adjustment) – 10 mV to 5 V/div at full bandwidth; 2 mV to 5 V/div at 20 MHz

Vertical Zoom – Vertically expand or compress a live or stopped waveform

Calibrated Position Range –
V/div Setting: 2 mV to 200 mV/div; >200 mV to 5 V/div
Offset Range: ±2 V; ±50 V

DC Gain Accuracy – ±3%

Vertical Resolution – 8-Bits (256 levels over 10.24 vertical divisions)

AUTOMATIC MEASUREMENTS
Period, Frequency, Cycle RMS, Mean, Peak to Peak

ACQUISITION MODES
Sample, Average, Peak Detect – High frequency and random glitch capture; captures glitches as narrow as 10 ns using acquisition hardware at all time/div settings between 5 µs/div and 5 s/div

TIME BASE SYSTEM (MAIN AND WINDOW)
Horizontal Zoom – Horizontally expand or compress a live or stopped waveform

Time/Division Range – 5 ns to 5 s/div

Record Length –
2500 sample points per channel

Horizontal Accuracy – ±0.01%

NON-VOLATILE STORAGE
Waveforms – Two 2500 point reference waveforms

Setups – 5 front panel setups

TRIGGERING SYSTEM (MAIN ONLY)
Trigger Type – Edge (Rising or Falling), Video, Set to 50%

Video Trigger Type – Triggers on Fields or Lines from sync-negative composite video; triggers on broadcast standard NTSC, PAL, or SECAM video

Trigger Modes – Auto, Normal, Single Sweep

Trigger Source – CH1, CH2, Ext, Ext/5

Trigger View – Displays trigger signal while trigger view button depressed

CURSORS
Types – Voltage, Time

Measurements – ΔT, 1/ΔT, ΔV

WAVEFORM PROCESSING
Arithmetic Operators – Add, Subtract, Invert.

Sources – CH1, CH2.

Autoset – Single button automatic setup on selected input signal for vertical, horizontal, and trigger systems.

DISPLAY SYSTEM
Robust, backlit LCD with adjustable multilevel contrast.

Interpolation – Sin(x)/x.

Modes – Vector, Dots, Dot Persistence.

Format – YT and XY.

ENVIRONMENTAL AND SAFETY
Temperature –
0° C to +50° C (Operating).
–20° C to +60° C (Nonoperating).

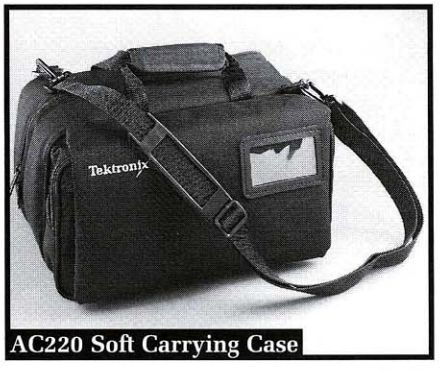
Humidity –
Up to 90% RH at or below +40° C.
Up to 60% RH from 41° C to 50° C (Operating and Nonoperating).

Altitude –
Up to 2000 m (Operating).
Up to 15,000 m (Nonoperating).

Electromagnetic Emissions – Meets Directive 89/336/EEC for Electromagnetic Compatibility; FCC Code of Federal Regulations, 47 CFR, Part 15, Subpart B, Class A.

Safety – UL 3111-1 Listed, EN61010, Certified CAN/CSA-C22.2 No. 1010.1-92.

TDS2CM Comm. Extension Module



AC220 Soft Carrying Case

Accessories

TDS2CM COMMUNICATIONS EXTENSION MODULE
Parallel Port – Centronics-type.

RS-232 Programmability – Full talk/listen modes. Control of all modes, settings, and measurements. Baud Rate up to 19,200. 9-Pin, DTE.

GPIB Programmability – Full talk/listen modes. Control of all modes, settings, and measurements (IEEE Std 488–1987).

TDS2HM HARDCOPY EXTENSION MODULE
Parallel Port – Centronics-type.

Accessories

TDS2MM MEASUREMENT EXTENSION MODULE
Ports – Centronics, RS-232 and GPIB.

FFT – Windows: Hanning, Rectangular, Flat top. Samples: 2048.

Automatic Measurements – Rise time, Fall time, Negative and Positive Pulse Width.

HARDCOPY CAPABILITY
Printer/File Formats – Thinkjet, Deskjet, Laserjet, Epson (9- or 24-Pin), BMP, PCX, IMG, EPS, DPU411, DPU412.

Hardcopy Layout – Landscape or Portrait.

Note: All 1.0 firmware versions will require FREE firmware upgrade.

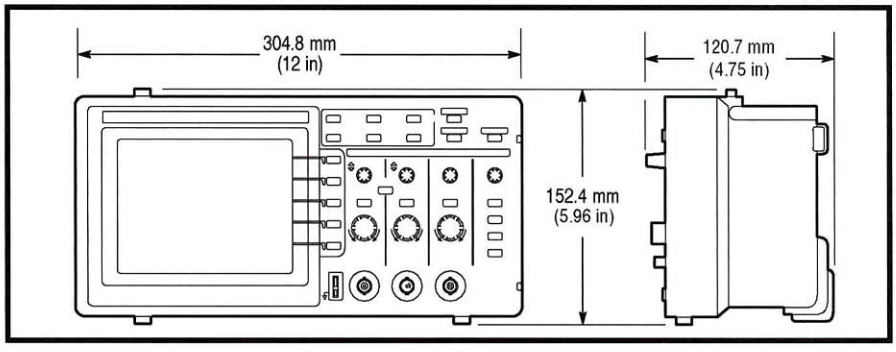
AC220
- Protects & Stores TDS 200 Series Scopes and Accessories During Transport from Site to Site

Digital Real-Time™ Oscilloscopes

TDS 210 • TDS 220

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	304.8	12.0
Height	151.4	5.96
Depth	120.7	4.75
Weight	**kg**	**lbs.**
oscilloscope only	1.5	3.25
w/ accessories	1.7	3.75



ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TDS 210/220
Two each P6112 100 MHz 10X Passive Probes
Includes: User Manual: English, Power Cord: U.S., NIST-Traceable Certificate of Calibration.

WARRANTY INFORMATION
Three year warranty covering all labor and parts, excluding probes.

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

INTERNATIONAL POWER PLUG OPTIONS
Standard – U.S. (161-0230-01).
Opt. A1 – Universal Euro 220 V, 50 Hz (161-0104-07).
Opt. A2 – United Kingdom 240 V, 50 Hz (161-0104-06).
Opt. A3 – Australia 240 V, 50 Hz (161-0104-05).
Opt. A4 – North America 240 V, 60 Hz (161-0104-08).
Opt. A5 – Switzerland 220 V, 50 Hz (161-0167-00).

INTERNATIONAL USER MANUALS (TDS 210 AND TDS 220).
Standard – English (070-8483-XX).
Opt. L1 – French (070-8520-XX).
Opt. L2 – Italian (070-8980-XX).
Opt. L3 – German (070-8484-XX).
Opt. L4 – Spanish (070-9560-XX).
Opt. L5 – Japanese (070-9562-XX).
Opt. L6 – Portuguese (070-9561-XX).
Opt. L7 – Simplified Chinese (070-9563-XX).
Opt. L8 – Traditional Chinese (070-9568-XX).
Opt. L9 – Korean (070-9564-XX).
French, Italian, German, Spanish, Portuguese front panel overlays included with their respective user manuals.

MEASUREMENT SERVICE OPTIONS
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

INTERNATIONAL USER MANUALS (TDS2CM, TDS2HM, TDS2MM).
Standard – English (070-9565-XX).
Opt. L1 – French (070-9567-XX).
Opt. L2 – Italian (070-9569-XX).
Opt. L3 – German (070-9566-XX).
Opt. L4 – Spanish (070-9570-XX).
Opt. L5 – Japanese (070-9572-XX).
Opt. L6 – Portuguese (070-9571-XX).
Opt. L7 – Simplified Chinese (070-9573-XX).
Opt. L8 – Traditional Chinese (070-9574-XX).
Opt. L9 – Korean (070-9575-XX).

RECOMMENDED ACCESSORIES
Also see page 438.
TDS2MM – Measurement Extension Module w/FFT.
Note: All 1.0 firmware versions will require FREE firmware upgrade.
TDS2HM – Hardcopy Extension Module.
TDS2CM – Communications Extension Module.
AC220 – Soft Carrying Case.
HC411 – Thermal Printer.
RM200 – Rackmount Kit.

SERVICE MANUAL (TDS 210 AND TDS 220)
English only (070-9693-XX).

TDS2CM, TDS2MM PROGRAMMER'S MANUAL
English only (070-9576-XX).

SOFTWARE
WSTR31 – WaveStar™ Waveform Capture Software.
WSTR31U – DocuWave® Software Upgrade to WSTR31.

PROBES
P6015A – 1000X High Voltage Probe.
P6021 – 60 MHz AC Current Probe.
P6022 – 120 MHz AC Current Probe.
A621 – 2000 A AC Current Probe/BNC.
A622 – 100 A AC/DC Current Probe/BNC.
P5100 – 100X High Voltage Passive Probe.
P5200 – High Voltage Differential Probe.
P6101B – 1X Passive Voltage Probe (15 MHz).
P6109B – 10X Passive Voltage Probe (100 MHz).
P6111B – 10X Passive Voltage Probe (200 MHz).
P6129B – 1X/10X Switchable Passive Voltage Probe (100 MHz).
P6243S – Active FET Probing System (1 GHz).
P6408 – Word Recognizer/Trigger Probe.
P6561A – SMD Small Geometry Probe.
AM503S – AC/DC Current Probe System.

ACCESSORY CABLES
GPIB, 1 m (3.3 ft) – Order 012-0991-01.
GPIB, 2 m (6.6 ft) – Order 012-0991-00.
RS-232 – 9-Pin female to 9-Pin female connectors, null modem, 76 inch (for AT style computers) Order 012-1379-00, 9-Pin female to 25-Pin female connectors, null modem, 76 in. (for PC style computers) (012-1380-00), 9-Pin female to 25-Pin male connectors, null modem, 9 ft. (for serial interface printers) (012-1298-00), 9-Pin female to 25-Pin male connectors, 15 ft. (for modems) (012-1241-00).
Centronics – 25-Pin male to 36-Pin Centronics, 2.4 meter (8 ft.) (for parallel printer interfaces) (012-1214-00).

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Handheld Battery Operated Oscilloscope/DMM

New TekScope® THS700 Series • THS730A • THS720A • THS710A

Features

THS730A/THS720A/THS710A

- 200, 100, and 60 MHz Bandwidth
- 1 GS/s, 500 MS/s, 250 MS/s Sampling Rates per Channel
- Two Channels and Dual Digitizers
- External Trigger
- 3-3/4 Digit DMM with Datalogger
- Roll Mode
- Extra Bright Backlit Display
- 8 ns Glitch Capture
- Independently Floating Isolated Scope and DMM Channels for Safety
- Advanced Trigger – Delay, Pulse, and Video (Line Count and Field Select)
- NiCd Battery and AC Adapter
- 21 Automatic Measurements
- RS-232 Programmability/Communications
- Deluxe Soft Carrying Case

New THS730A

THS730A/THS720A/ THS710A/TekScope Series

The TekScope THS700A Series Scope/DMM combines a full-featured Digital Real-Time™ oscilloscope with a True RMS digital multimeter in rugged, battery-operated instruments. Scope and meter modes can operate simultaneously and independently on the same or separate signals. The high-resolution, backlit display and pop-up menus make it easy for users to take full advantage of the instrument's many features. These include cursors, video trigger, voltage and resistance measurements, and storage of waveforms, data, and instrument setups. In addition, they offer the most comprehensive triggering capabilities – external trigger and extensive triggering including delay, pulse width, and video.

The THS700A Series is ideal for electronic applications – at the bench or at the site.

The THS700A Series shares measurement features with the THS720P Scope/DMM which includes features to address the needs of electric/power electronics measurements.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

CHARACTERISTICS

Oscilloscope Functions

	THS730A	THS720A	THS710A
Bandwidth	200 MHz	100 MHz	60 MHz
Sample Rate (Each Channel)	1 GS/s	500 MS/s	250 MS/s
Time/Division Range	2 ns to 50 s/div	5 ns to 50s/div	10 ns to 50s/div

Handheld Battery Operated Oscilloscope/DMM

New TekScope® THS700 Series • THS730A • THS720A • THS710A

OSCILLOSCOPE FUNCTIONS

Channels – Two.

Sensitivity – 5 mV to 50 V/div (to 500 V/div with 10X probe).

Position Range – ±10 div.

DC Gain Accuracy – ±2%.

Vertical Resolution – 8-Bits.

Record Length – 2500 points.

Horizontal Accuracy – ±200 ppm.

Roll Mode – >= 0.5 s/div.

Autorange – User-selectable.

Trigger Modes – Auto, Normal.

Trigger Types – Edge, Pulse, Video, External.

Video Trigger Formats and Field Rates – Odd field, even field, and line.

External Trigger Input – 5 MHz TTL compatible.

Waveform Processing – Add, Subtract, Multiply, Calculate Watts = V x I.

Waveform Storage – 10 waveforms.

Acquisition Modes – Sample, Envelope, Average, Peak Detect.

Cursor Measurements – *delta Volts, delta *Time, 1/*deltaTime (Hz), Degree (phase).

Cursor Types – Horizontal Bars, Vertical Bars, Paired (volts @ time).

Display System –
Interpolation: Sin(x)/x.
Mode: Vector, Dot, Vector Accumulate, Dot Accumulate.
Format – YT and XY.

Automatic Measurements:

Period	Frequency
+Width	–Width
Rise Time	Fall Time
+Duty Cycle	–Duty Cycle
+Overshoot	–Overshoot
High	Max,
Low	Min,
Peak-to-Peak	Amplitude
Mean	RMS
Cycle Mean	Cycle RMS,
Burst Width	

DMM SPECIFICATIONS

DC Voltage Ranges – 400.0 mV to 880 V.

DC Volts Accuracy – ±(0.5% of reading + 5 counts).

True RMS AC Voltage Ranges – 400.0 mV to 640 V.

Maximum Float Voltage – 600 VRMS each channel (probe dependent).

Resolution – 4000 count, 3-3/4 digits.

AC Volts Accuracy – ±(2% of reading + 5 counts).

Resistance Ranges – 400.0 Ω to 40.00 MΩ.

Resistance Accuracy – ±(0.5% of reading + 2 counts); 40 MΩ: ±(2% of reading + 5 counts).

Diode Test Range – 0 to 2 V.

Continuity Check – Audible tone when < 50 Ω.

Modes – Min, Max, delta *Max-Min, Avg, Hold.

Non-volatile Storage – 10 DMM screenshots.

External Trigger Input – 5 MHz TTL compatible.

Vertical Zoom Capability – 2X, 5X, 10X.

dB Scale – Selectable, referenced from 1 mV to 10 V.

dBm Scale – Selectable, referenced from 50 Ω to 600 Ω.

GENERAL SPECIFICATIONS

Setups – 10 front-panel setups.

Safety Certification – UL 3111-1 Listed, CSA Certified, complies with EN61010-1.

Power – NiCd rechargeable battery pack with AC adapter (both included).

Battery Life – Approx. 2 hours from full charge.

Display – Backlit LCD.

Display Resolution – 320 x 240.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	177	6.95
Height	217	8.53
Depth	51	2.00
Weight	**kg**	**lbs.**
Net	1.45	3.2

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

THS730A, THS720A, THS710A
Handheld Battery Operated Oscilloscopes/DMM.
Includes: Two P6117 10X Passive Probes, User Manual, Quick Reference Manual, Standard Meter Lead Set, NiCd Rechargeable Battery Pack, AC Power Adapter, Soft Carrying Case, Cable and Adapters for RS-232, NIST-traceable Certificate of Calibration.

THS700A LANGUAGE OPTIONS

Opt. L1 – French User Manual.
Opt. L2 – Italian User Manual.
Opt. L3 – German User Manual.
Opt. L4 – Spanish User Manual.
Opt. L5 – Japanese User Manual.
Opt. L6 – Portuguese User Manual.
Opt. L7 – Simplified Chinese User Manual.
Opt. L8 – Traditional Chinese User Manual.
Opt. L9 – Korean User Manual.

THS700A POWER ADAPTER OPTIONS

Opt. A1 – European power plug.
Opt. A2 – UK power plug.
Opt. A6 – Japanese power plug.

RECOMMENDED ACCESSORIES
Also see page 438.

P5102 – 10X 100 MHz Passive Probe for higher voltage application: 1000V_{RMS} Tip-to-reference; 600 V_{RMS} Reference-to-earth Ground (float).
A621, A622 – Current Probes for scope operation.
A605, A610 – Current Probes for DMM operation.
P6117 (replacement) – 10X Passive Probe.
Battery Charger – THS7CHG.
Rechargeable Battery (replacement) – THS7BAT.
Hard Carrying Case – THS7HCA.
Standard Meter Lead Set (replacement) – 012-1482-00.
Deluxe Meter Lead Set – ATLDX1.
Programming Manual – 070-9751-00.
Service Manual – 070-9752-00.
Soft Carrying Case (replacement) – 016-1399-01.
Printer – HC411 Thermal Printer.
WaveStar Electronic Lab Notebook Software – WSTR31. Windows-based software to capture waveforms and settings from Tektronix DSOs.

WARRANTY
Three years (excluding probes).

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

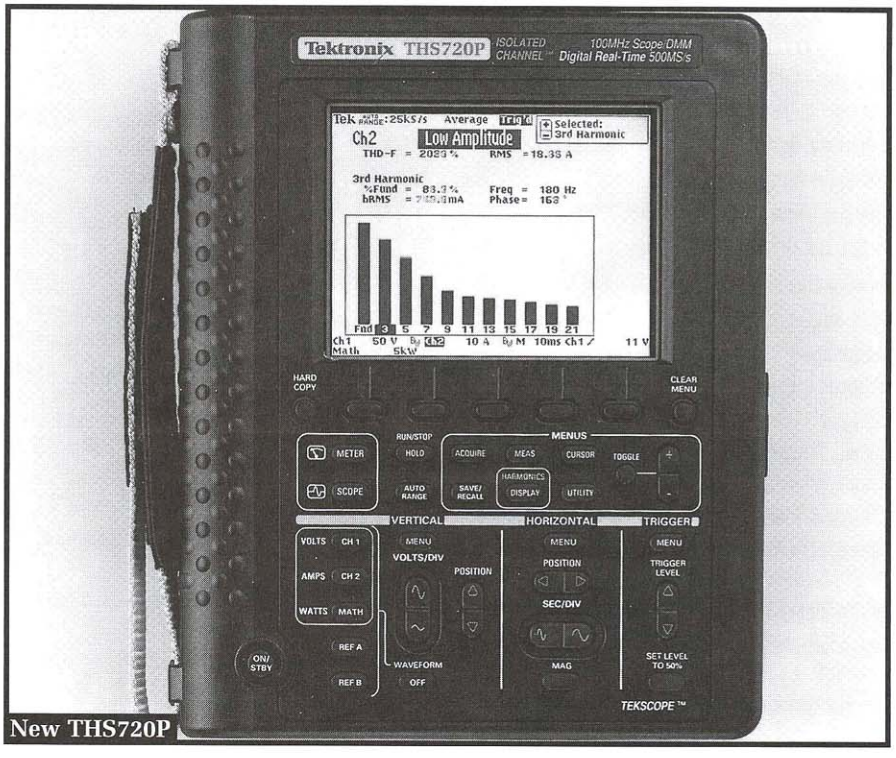
Handheld Battery Operated Oscilloscope/DMM

New TekScope® THS700 Series • THS720P

Features

THS720P

- Measures Harmonics up to 31st (50/60 Hz)
- Automatic Power Measurement with Statistics
- Independently Floating Isolated Scope and DMM Channels for Safety
- Full Floating Measurement Capability up to 600 V_{RMS}
- 1 kV High-voltage Probes
- PWM Electric Motor Drive Trigger
- 100 MHz Bandwidth with 500 MS/s Sampling Rate per Channel
- Two Channels and Dual Digitizers
- External Trigger
- 3-3/4 Digit DMM with Datalogger
- Roll Mode
- Extra Bright Backlit Display
- 8 ns Glitch Capture
- Advanced Trigger – Delay, Pulse, Video (Line Count and Field Select)
- NiCd Battery and AC Adapter
- 21 Automatic Measurements
- RS-232 Programmability/Communication
- Deluxe Soft Carrying Case



New THS720P

The Only Safe Measurement Solution for Power Electronics

The THS720P TekScope IsolatedChannel™ Scope/DMM is ideal for electric/power electronics applications. It combines a full-featured 100 MHz bandwidth and 500 MS/s sample rate Digital Real-Time™ oscilloscope with a True RMS digital multimeter in a rugged, battery-operated instrument. Scope and meter modes can operate simultaneously and independently on the same or separate signals. The high-resolution, backlit display and pop-up menus make it easy for users to take full advantage of the instrument's many features. These include cursors, video trigger, voltage and resistance measurements, and storage of waveforms, data, and instrument setups.

The THS720P includes features specifically for electric/power electronics measurements which allow testing and verifying correct operation of motors, checking transformer efficiency, verifying power-supply performance, and measuring the effect of neutral current. It also contains the powerful features of a modern oscilloscope that enable troubleshooting and verification of complicated electronic control circuits controlling the high-voltage power-electronics circuitry.

The THS720P shares measurement features with the THS730A, THS720A, THS710A Scope/DMMs, which are ideal for electronic applications.

Characteristics

OSCILLOSCOPE FUNCTIONS

Bandwidth – 100 MHz.

Sample Rate (Each Channel) – 500 MS/s.

Channels – Two.

Sensitivity – 5 mV to 50 V/div (to 500 V/div with 10X probe).

Position Range – ±10 div.

DC Gain Accuracy – ±2%.

Vertical Resolution – 8-Bits.

Record Length – 2500 points.

Time/Division Range – 5 ns to 50 s/div.

Horizontal Accuracy – ±200 ppm.

Roll Mode – ≥ 0.5 s/div.

Autorange – User-selectable.

Trigger Modes – Auto, Normal.

Trigger Types – Edge, Pulse, Video, Motor, External.

Video Trigger Formats and Field Rates – Odd field, even field, and line.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Handheld Battery Operated Oscilloscope/DMM

New TekScope® THS700 Series • THS720P

Motor Trigger – Triggers on 3- and 5-level pulse-width modulated power signal.

External Trigger Input –
5 MHz TTL compatible.

Harmonics – Up to 31st (50/60 Hz).

Waveform Processing – Add, Subtract, Multiply, Calculate Watts = V x I.

Waveform Storage – 10 waveforms.

Acquisition Modes – Sample, Envelope, Average, Peak Detect.

Cursor Measurements – ΔVolts, ΔTime, 1/ΔTime (Hz), Degree (phase).

Cursor Types – Horizontal Bars, Vertical Bars, Paired (volts @ time).

Display System –
Interpolation: Sin(x)/x.
Mode: Vector, Dot, Vector Accumulate, Dot Accumulate.
Format: YT and XY.

Automatic Measurements –

Period	Frequency
+Width	Rise Time
–Width	Fall Time
+Duty Cycle	+Overshoot
–Duty Cycle	–Overshoot
High	Max
Low	Min
Peak-to-Peak	Amplitude
Mean	RMS
Cycle Mean	Cycle RMS
Burst Width	

Power Measurements –

W	True power
VA	Apparent power
VAR	Reactive power
V	Volts (RMS, Peak)
A	Amps (RMS, Peak)
THD-F	Total harmonic distortion as a percentage of the fundamental
THD-R	Total harmonic distortion of the RMS of the input signal
PF	Power factor
DPF	Displacement power factor
φ	Phase difference between the voltage and current

DMM SPECIFICATIONS

DC Voltage Ranges – 400.0 mV to 880 V.

DC Volts Accuracy – ±(0.5% of reading + 5 counts).

True RMS AC Voltage Ranges – 400.0 mV to 640 V.

Maximum Float Voltage – 600 V_{RMS} each channel (probe dependent).

Resolution – 4000 count, 3-3/4 digits.

AC Volts Accuracy – ±(2% of reading + 5 counts).

Resistance Ranges – 400.0 Ω to 40.00 MΩ.

Resistance Accuracy –
±(0.5% of reading + 2 counts); 40 MΩ: ±(2% of reading + 5 counts).

Diode Test Range – 0 to 2 V.

Continuity Check – Audible tone when <50 Ω.

Modes – Min, Max, ΔMax-Min, Avg, Hold.

Non-volatile Storage – 10 DMM screenshots.

External Trigger Input –
5 MHz TTL compatible.

Vertical Zoom Capability – 2X, 5X, 10X.

dB Scale – Selectable, referenced from 1 mV to 10 V.

dBm Scale – Selectable, referenced from 50 Ω to 600 Ω.

GENERAL SPECIFICATIONS

Setups – 10 front-panel setups.

Safety Certification – UL 3111-1 Listed, CSA Certified, complies with EN61010-1.

Power – NiCd rechargeable battery pack with AC adapter (both included).

Battery Life – Approx. 2 hours from full charge.

Display – Backlit LCD.

Display Resolution – 320 x 240.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	177	6.95
Height	217	8.53
Depth	51	2.00
Weight	**kg**	**lbs.**
Net	1.45	3.2

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

THS720P
Handheld Battery Operated Oscilloscope
Includes: Two P5102 10X High-voltage Passive Probes, User Manual, Quick Reference Manual, Standard Meter Lead Set, NiCd Rechargeable Battery Pack, AC Power Adapter, Soft Carrying Case, Cable and Adapters for RS-232, NIST-traceable Certificate of Calibration.

THS720P LANGUAGE OPTIONS
Opt. L1 – French User Manual.
Opt. L2 – Italian User Manual.
Opt. L3 – German User Manual.
Opt. L4 – Spanish User Manual.
Opt. L5 – Japanese User Manual.
Opt. L6 – Portuguese User Manual.
Opt. L7 – Simplified Chinese User Manual.
Opt. L8 – Traditional Chinese User Manual.
Opt. L9 – Korean User Manual.

THS720P POWER ADAPTER OPTIONS
Opt. A1 – European Power Plug.
Opt. A2 – UK Power Plug.
Opt. A6 – Japanese Power Plug.

TEKTRONIX MEASUREMENT SERVICE OPTIONS
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

RECOMMENDED ACCESSORIES
Also see page 438.

P5102 (replacement) – 10X 100 MHz Passive Probe for higher voltage application: 1000 V_{RMS} Tip-to-reference; 600 V RMS Reference-to-earth Ground (float).
A621, A622 – Current Probes for scope operation.
A605, A610 – Current Probes for DMM operation.
P6117 – 10X Passive Probe.
THS7CHG – Battery Charger.
THS7BAT – Rechargeable Battery (replacement).
THS7HCA – Hard Carrying Case.
Standard Meter Lead Set (replacement) – Order 012–1482-00.
Deluxe Meter Lead Set – ATLDX1.
Programming Manual – Order 070-9751-00.
Service Manual – Order 070-9752-00.
Soft Carrying Case (replacement) – Order 016-1399-01.
Printer – HC411 Thermal Printer.
WaveStar Electronic Lab Notebook Software – WSTR31. Windows-based software to capture waveforms and settings from Tektronix DSOs.

WARRANTY
Three years (excluding probes).

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

Digitizing Oscilloscopes

11800 Series • CSA Series

CONTENTS

11800 SERIES OSCILLOSCOPES/PLUG-INS

11801B 12.5 to 50 GHz Digital Sampling.....95

11801B/CSA 803A Sampling Heads.....102

IPA 510 Interconnect Parameter Analyzer.....108

CSA SERIES COMMUNICATIONS SIGNAL ANALYZERS

CSA 803A up to 50 GHz Color.....330

ACCESSORIES

Probes.....438

SMD Adapters.....474

Probe and Instrument Accessories.....480

Printer.....522

Instrumentation Carts.....524

Software (WaveStar).....112

11800 Series

The Tektronix 11800 Series is a powerful set of analysis tools that alters your fundamental expectations of an oscilloscope. Most revolutionary is the simplification and automation of the entire measurement and analysis process. Accuracy, sensitivity, bandwidth, offset, and overdrive recovery are provided by a well-planned instrument family having plug-in versatility and performance. Multiprocessor architecture allows for simultaneous display of up to eight waveforms and up to six dynamic, "live" measurement readouts. The automation needs of scientific and production environments are easily met by integrating these instruments into a measurement system through RS-232-C or GPIB interfaces.

CSA Series

The Communications Signal Analyzer (CSA) offers signal analysis and the powerful measurement capabilities required to analyze high-speed digital communication signals. Features of the CSA 803A include histograms, mask testing, and a color-graded display, allowing you to perform accurate measurements such as jitter, noise, and phase.

High Performance Digitizing Oscilloscopes

11800 Series • CSA Series

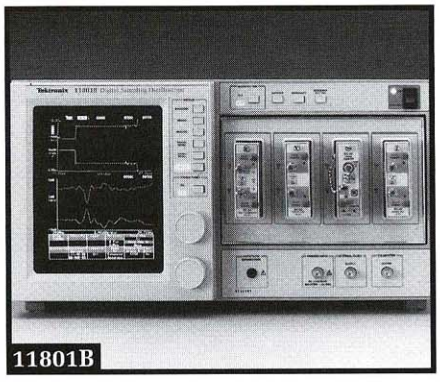
Features

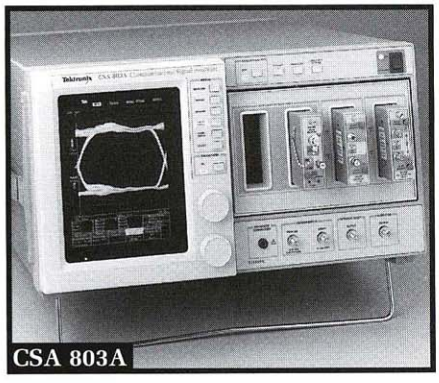
11801B

- DC to 50 GHz Bandwidth (7 ps Rise Time)
- 8 Channels, Expandable to 136
- Automatic Statistical Measurements, Histograms and Mask Testing

CSA 803A

- DC to 50 GHz Bandwidth (7 ps Rise Time)
- High Resolution and Repeatability
- Automatic Statistical Analysis
- 38 Standard Communication MASKS
- 10 GHz Triggering
- TDR and FFT





11801B

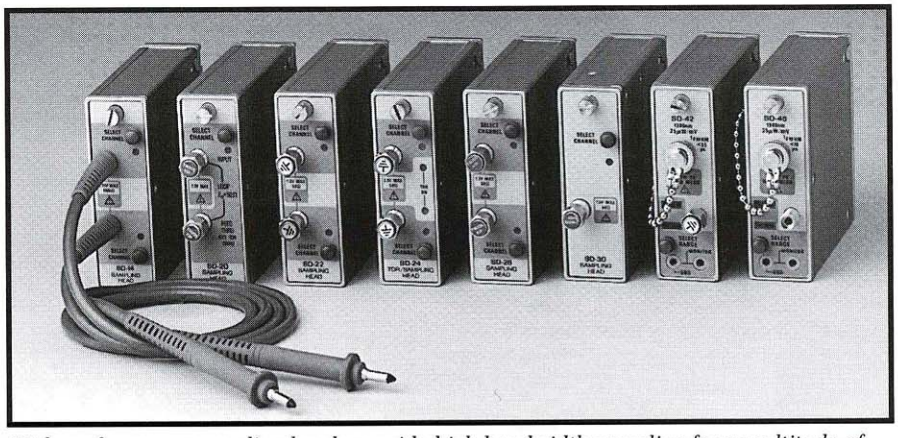
The 11801B uses sequential equivalent-time sampling technology to achieve bandwidths of up to 50 GHz. Sampling head modularity provides a variety of acquisition methods including TDR, optical coupling, loopthrough sampling, low-noise sampling, triggering, and probe sampling. Up to 136 channels of acquisition and TDR measurements can be achieved with an 11801B. The 11801B provides the highest timing resolution and measurement repeatability of any of the 11800 Series.

CSA 803A

The CSA 803A Communications Signal Analyzer is designed for viewing communication signals up to 50 GHz.

Histogram, masking testing, and a color-graded display are included to form an ideal tool for analyzing eye diagrams.

The CSA 803A provides many automatic measurements analyses, including Extinction Ratio, FFT, and Autoset to industry standard Masks. The CSA 803A offers TDR, 10 GHz triggering and 2.0 ps RMS jitter (1.3 ps typical).



High performance sampling heads provide high bandwidth sampling for a multitude of applications.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

High Performance Digitizing Oscilloscopes

11800 Series • CSA Series

ACCURACY

Measurement accuracy sets the 11800 Series apart from all other oscilloscopes. The analog input circuitry is the most advanced in any oscilloscope – digital or analog. The plug-in amplifiers are built to maintain signal integrity over a wide dynamic range. The 11800 Series delivers accuracy across widely varying conditions of signals and settings; you don't have to worry about whether you're viewing your signal or seeing the oscilloscope's amplifier anomalies.

The Enhanced Accuracy feature of the 11800 Series provides worry-free and effortless automatic internal calibration of the instrument. The instruments continually monitor themselves for accuracy.

FLEXIBILITY AND POWER

The 11800 Series provides plug-in versatility. Nine plug-in amplifiers, ten sampling heads, and a variety of probes are currently available to tailor a signal conditioning solution to your measurement needs.

Whether it is multi-channel (up to 136), 50 Ω/1 MΩ inputs, differential, high bandwidth or optical, the 11800 Series of oscilloscopes offers more versatility than any other oscilloscope. No other oscilloscope can provide the performance, accuracy, sensitivity, bandwidth, filtering, offset, or overdrive recovery of the 11800 Series amplifiers and probes.True dual time bases let you view portions of a waveform at much higher resolution than the main trace. This provides measurement flexibility and improved accuracy. Record lengths can be specified separately for main waveforms and window waveforms, as the application dictates. Two windows allow you to view and measure two separate events at fast sweep speed, improving the accuracy of measurements of those events.

The CSA 803A offers histograms and mask testing to specifically perform the measurements on signals that are typical in communication applications. Histograms are powerful measurement tools for measuring jitter and noise. Mask testing is a very beneficial tool in ATE applications for measuring noise margin and jitter tolerance.

The CSA 803A includes outstanding analysis and acquisition capabilities including FFT, Extinction Ratio, 38 industry standard Masks (CCITT + ANSI), TDR, 10 GHz triggering and 1.3 ps RMS (typical) jitter.

DIGITAL SIGNAL PROCESSING

The 11800 Series provides capability far beyond the basic four math functions of +, –, x, and ÷. It also provides more complex waveform processing such as differentiation, integration, square root, logarithms and more. In all, more than ten different signal processing options are available.

The architecture has the power to display these defined waveforms in real time and make measurements directly on the complex waveforms.

AUTOMATION

Each 11800 Series Oscilloscope provides both RS-232-C and IEEE 488 Standard interfaces. The 11800 Series provides ideal solutions for both low cost benchtop automation and rackmount production applications.

Tektronix offers several compatible software packages to support the 11800 Series in scientific and production applications. Scientists will find that the series is supported by many of the most popular controllers and software packages. Template software from Tektronix supports both process and production environments.

HARDCOPY SUPPORT

You can also print date and timestamped copies of the screen at the push of a button or a bus command. Support for electronic import of hardcopies is also provided.

11800 SERIES SELECTION GUIDE

Instrument	Bandwidth	Maximum # of Channels	Sample Rate	Maximum Record Length	Vertical Resolution	Digitizing Technology
11801B	50 GHz	136	200 kS/s	5 K	8-Bits	sequential
CSA 803A	50 GHz	4	200 kS/s	5 K	8-Bits	equivalent time

Digital Sampling Oscilloscope
11801B

Features

11801B

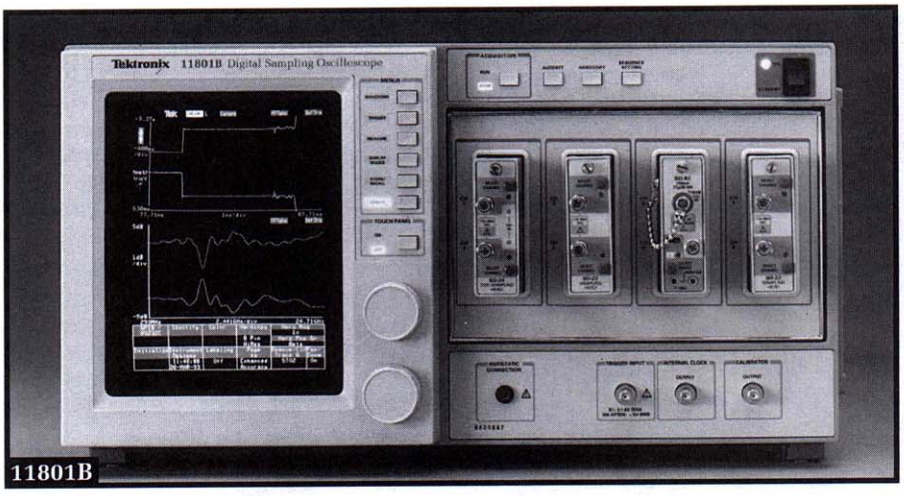
- DC to 50 GHz Bandwidth
- 7 ps Rise Time
- 8 Channels, Expandable to 136 (with SM-11)
- 10 fs Sampling Interval (0.01 ps)
- Modular Architecture
- 200 kS/s Sample Rate
- Triggering to 10 GHz (Prescaler)
- Dual Time Base
- Non-volatile Waveform and Setting Storage
- FFT
- Predefined Telecom Masks
- TDR
- Automatic Measurements:
  Jitter/ Noise,
  Statistical,
  Histograms,
  Mask Testing,
  Pulse with Statistics
- Programmable for ATE Applications
- Color Display

BENEFITS

- Comprehensive Waveform Processing

Applications

- Semiconductor Testing
- TDR Characterization of Circuit Boards, IC Packages and Cables



11801B Digital Sampling Oscilloscope

The 11801B Digital Sampling Oscilloscope offers the widest range of on-board measurement and waveform processing capabilities of any multi-gigahertz scope. With excellent measurement repeatability, exceptional vertical resolution and the fastest display update rate, the 11801B is a powerful measurement tool for semiconductor testing, TDR characterization of circuit boards, IC packages and cables, and high-speed digital data communications. An easy-to-use touch screen display gives you instant access to the 11801B's extensive waveform processing and measurement functions.

MODULARITY MEETS YOUR NEEDS NOW AND IN THE FUTURE

The modular microprocessor-based architecture of the 11801B not only allows you to select the right configuration for your application, but also allows expandability to meet your future measurement needs. The 11801B accepts up to four dual-channel sampling heads and can be expanded through the SM-11 Multi-channel Units to 136 channels.

There are currently ten sampling heads to choose from:

SD-14	3 GHz high impedance (100 kΩ/0.5 pF) dual-channel probe sampler
SD-20	20 GHz single-channel loopthrough head
SD-22	12.5 GHz dual-channel low noise head
SD-24	20 GHz dual-channel TDR/sampling head
SD-26	20 GHz dual-channel sampling head
SD-32	50 GHz single-channel sampling head
SD-42	6.4 GHz O/E converter (55 ps optical pulse response FWHM)
SD-46	20 GHz O/E converter (22 ps optical pulse response FWHM)
SD-51	20 GHz trigger head

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digital Sampling Oscilloscope
11801B

STATE-OF-THE-ART WAVEFORM ACQUISITION

The state-of-the-art timebase provides equivalent-time sweep rates from 1 ps/div to 5 ms/div, with record lengths from 512 points to 5120 points, and a sample interval of 10 femtoseconds (0.01 ps). The 11801B also offers true windowing, whereby sections of a main trace are re-acquired at higher resolution for close examination of details. The windows are not just a digital zoom as in some competitive instruments. Only Tektronix sampling scopes offer such high resolution viewing of the main acquisition. The acquisition system provides 8-Bit vertical resolution at all deflection factors (78 µV/LSB at 2 mV/div). Powerful on-board waveform processing allows usable deflection factors down to 100 µV/div, giving resolution well beyond the basic 2 mV/div sensitivity of the sampling system itself. The 11801B boasts the fastest sample rate among sampling scopes. The 200 kHz sampling rate gives "real-time" feel for waveform manipulation and increases throughput on data capture for histograms and measurements.

A POWERFUL MEASUREMENT TOOL ON YOUR BENCH

The 11801B offers a comprehensive, accurate and automatic measurement system. A total of 28 on-board measurements can be conveniently selected through the touch screen measurement menu. Results of up to six measurements may be simultaneously displayed on the screen, continuously updated to follow changing signal conditions. However, any number of measurements may be made over GPIB or RS-232-C interfaces. There are three different modes of measurements: hardware, software and statistics. Hardware mode allows high throughput on timing measurements and simultaneous measurements on up to 68 channels at once. Statistics mode uses the statistical database to make all the measurements based on the statistical distribution of the data over multiple acquisitions. It provides very stable and accurate measurements even in the presence of jitter or noise. With the statistical measurement mode, direct automatic jitter and noise measurements are possible (see Figure 1). This eliminates the human judgment and error that comes with manual measurements from histograms. As in all the other 11000 Series instruments, software measurement mode uses IEEE algorithms to make measurements based on digitized waveforms. An alternate Tektronix proprietary algorithm that is optimized for pulses with ringing and other anomalies is also selectable.

FFT

The 11801B offers FFT display and measurements as a useful tool for the design engineer and scientist. FFT magnitude or phase displays can be created from the acquired waveform and the automatic Spectral Frequency, Spectral Magnitude, and THD (Total Harmonic Distortion) measurements can be used for a complete analysis (see Figure 2).

COLOR GRADING AND MASK/TEMPLATE TESTING

The power of the measurement capabilities of the 11801B can be extended even further with color graded display, histogramming capabilities and mask testing. Both vertical and horizontal histograms, with periodically updated measurements such as mean, RMS and peak-to-peak allow statistical distributions to be analyzed at any point on the signal. The statistical database, available in the color graded display, not only adds a third dimension to your waveforms (by showing a point density of the samples), but also avoids time consuming re-acquisitions or repeated histogram analysis and statistical measurements. The mask testing capability of the 11801B provides an easy, yet powerful and quantitative way to characterize metastability in your device or system. In addition to custom mask editing, the 11801B offers AutoMask – 38 standards-defined masks in memory for instant recall. This together with automatic waveform scaling, gives a rapid verification of a digital bit stream's conformance to pulse templates or eye pattern masks (see Figure 3, on following page).

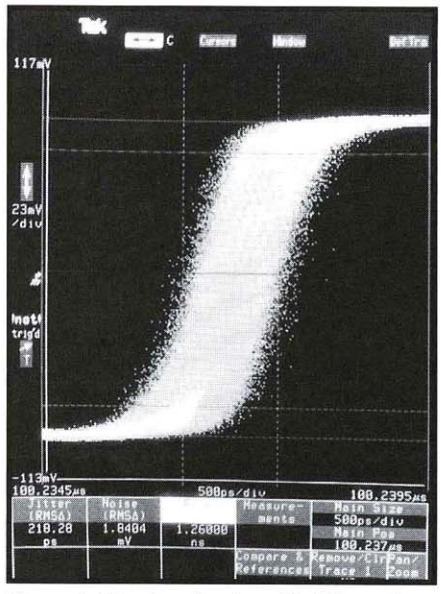


Figure 1. Direct and automatic jitter, noise and rise time measurement using the statistical measurement mode.

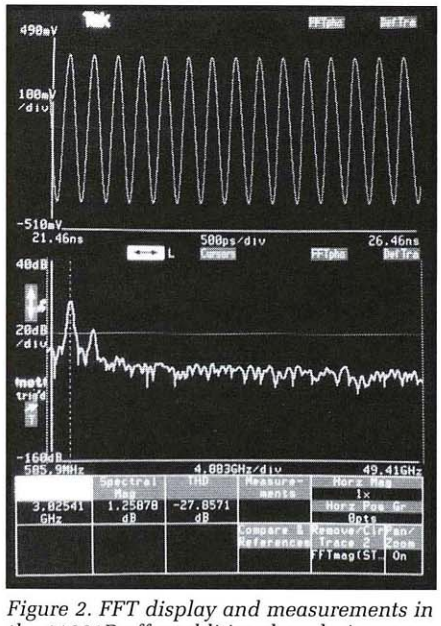


Figure 2. FFT display and measurements in the 11801B offer additional analysis power to the engineer or scientist.

Digital Sampling Oscilloscope
11801B

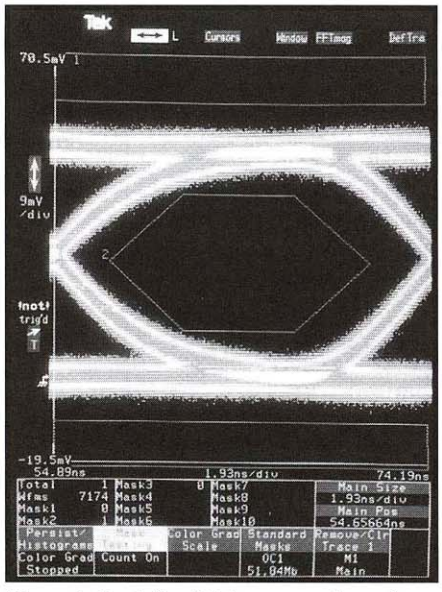


Figure 3. Predefined Telecom masks make verifying digital stream conformance simple.

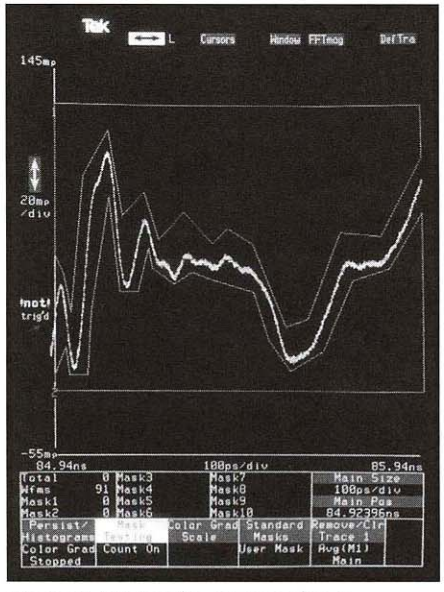


Figure 4. TDR go/no-go impedance measurement using masks.

UNMATCHED TDR CAPABILITIES

With the SD-24 dual-channel TDR/Sampling Head, the 11801B offers full 20 GHz acquisition and unmatched TDR performance on up to 136 channels. Each channel has an independent polarity-selectable (positive-going or negative-going) TDR step generator. The TDR outputs can also be precisely matched at a reference plane, providing the only true integrated differential TDR system available today. Differential TDR offers an accurate picture of the performance of balanced or unbalanced differential systems such as twisted pair cables, coupled microstrips, or differential inputs in active devices. Tektronix' differential TDR system is the only system available today that offers true differential TDR with live waveform updates and simple direct readout of impedance. Other systems require complex and error-prone computations and do not provide direct readout in ohms.

The step generator of the SD-24 also represents state-of-the-art technology, offering unmatched 35 ps reflected rise time*[1], with the flattest step in the industry. TDR is also simple to use, with one-touch preset functions for both single-ended and differential TDR. There is direct readout of impedance in rho and ohms, as well as readout of one way or round trip distance in meters, feet, or inches. Using the mask testing capability of the 11801B, you can perform go/no-go testing of impedances in circuit board runs, IC packages and cables (see Figure 4).

Single-ended and differential TDT (Time Domain Transmission) is also possible with the 11801B and SD-24. This type of testing may involve transmission testing (an end-to-end measurement through a cable or conductor), or crosstalk testing (signals induced on one or more adjacent cables or conductors). The ability to apply a step on any channel of the 11801B means that both forward and reverse testing is possible without switching test channels or relay multiplexing, which can be prone to errors. Any of the above measurements may be performed single-ended or true differential.

The 11801B allows quick real-time viewing of the TDR response to a user-selected rise time with the filter function. Simply enter the filter rise time, and the 11801B displays a live trace that shows the response at the filtered rise time. Waveform math can also be used to subtract a reference trace acquired with a 50 Ω terminator for removal of unwanted aberrations due to cabling and fixturing.

WAVEFORM MEMORY AND NON-VOLATILE STORAGE

The 11801B is equipped with 512 KB of volatile waveform acquisition and display memory, and 256 KB of non-volatile memory for storage of waveforms and settings. These memories are independent; that is, the number of waveforms being acquired has no impact on the memory available for stored waveforms and settings.

MULTI-CHANNEL CAPABILITIES

The SM-11 Multi-channel Unit provides the means of expanding the 11801B's measurement system to 136 channels. Each SM-11 accepts up to 16 SD-Series sampling heads for 32 channels (with dual-channel heads). An 11801B mainframe with Option 1M is capable of driving up to four SM-11s. The entire system can then be driven through a single GPIB address. The 11801B acquisition system is designed to simultaneously acquire half of all active channels in a single acquisition cycle. Thus, in two acquisition cycles, all 136 channels can be acquired, and measurements performed on them. All channels, whether in the 11801B or SM-11 mainframes, offer the full specified performance. There is no loss of performance throughput or reliability as is the case in relay-multiplexed systems.

EASY-TO-USE HUMAN INTERFACE

The power of the 11801B is accessed through a simple menu structure with pop-up menus and two control knobs. In addition, common functions such as time/div and volts/div, are accessed through on-screen icons which are always accessible. For ATE applications, the 11801B is completely programmable through its IEEE 488 and RS-232-C interfaces.

DOCUMENTATION

The 11801B provides extensive hardcopy support. Documenting your results, complete with labels and time and date stamp, is as easy as pressing the HARDCOPY button. A variety of printers and plotters are supported. TIFF (Tagged Image File Format) output is also supported for exporting hardcopy to word processors.

[1] The observed rise time of a reflection from a short circuit.

Digital Sampling Oscilloscope
11801B

Characteristics

VERTICAL SYSTEM*1

Rise Time/Bandwidth – Determined by the sampling head used.

Vertical Resolution – 8-Bits full screen (78 µV/LSB at 2 mV/div deflection factor).

Amplifier Gain Accuracy – ±1% of all settings.

Deflection Factors – 2 to 255 mV/div in 1 mV/div increments.

Offset Range – ±2 V.

HORIZONTAL SYSTEM

Main and Window Time Base – 1 ps/div to 5 ms/div, settable to 1-2-5 sequence or in 1 ps increments.

Record Length – 512, 1024, 2048, 4096, and 5120 samples.

Windows – Any number of window records may be placed on any number of main records, up to a maximum of eight displayed traces. All window records have the same duration, but may be independently positioned on any main record. Windows may be set to automatically track a moving edge on the main record.

Maximum Sample Rate – 200 kS/s.

TRIGGER SYSTEM*2

Trigger Bandwidth (Direct) – 3 GHz; 2-10 GHz (Prescaled).

Trigger Sensitivity (Direct) –
DC, 1X ≤3 GHz: 100 mV;
AC, 1X 300 kHz to 3 GHz: 100 mV;
DC, 10X ≤3 GHz: 1 V;
AC, 10X 300 kHz to 3 GHz: 1 V.

Delay Jitter – 1.3 ps +4 ppm of a position typical. 2.0 ps +5 ppm of position maximum (RMS).

Internal Clock – 100 kHz (drives TDR, Internal Clock Output, and Calibrator).

Trigger Level Range (Direct) – ±1.0 V (±10 V with 10X trigger attenuator activated).

Trigger Input Range (Direct) – ±1.5 V (+15 V, 5 V RMS maximum with 10X).

Trigger Holdoff – 5 µs to 2.5 s.

MEASUREMENT SYSTEM

Waveform Processing Functions – Add, subtract, multiply, divide, absolute, average, differentiate, envelope, exponent, integrate, natural log, log, signum, square root, smoothing, and filter.

Measurement Set – Max, min, mid, p-p, mean, RMS, amplitude, extinction ratio, overshoot, undershoot, noise*5, rise, fall, spectral magnitude, spectral frequency, THD, SNR, frequency, period, prop delay, cross, width, phase, duty cycle, jitter*5, area +, area –, and energy. Measurements are constantly updated; mean and standard deviation available on all measurements.

Measurement Parameters – (Proximal, mesial, distal, and start/stop levels). May be set to absolute levels.

Cursors – Paired or split dots, vertical bars, and horizontal bars.

TDR SYSTEM (SD-24 ONLY)

Combined TDR/Acquisition Reflected Rise Time – 35 ps or less.

TDR Step Amplitude – Adjustable to ±250 mV (polarity of either step may be inverted).

Time Coincidence Between TDR Steps – Adjustable to less than 1 ps.

Source Resistance – 50 ±0.5 Ω.

Typical Aberrations – (at ±250 mV Amplitude) 10 ns to 20 ps before step: ±3% or less; Less than 300 ps after step: +10%, –5% or less; 300 ps to 5 ns after step: ±3% or less; Elsewhere: ±1% or less.

CRT AND DISPLAY FEATURES

CRT – 9 inch diagonal, magnetic deflection, vertical raster scan orientation. Color.

Colors – Eight-color default color set included; or colors are user-selectable from palette of 262,144 colors.

Video Resolution – 552 horizontal by 704 vertical displayed pixels.

POWER REQUIREMENTS

Line-voltage Ranges – 90 to 132 V RMS, 180 to 250 V RMS.

Line Frequency – 48 to 440 Hz.

Maximum Power Consumption – 214 W.

ENVIRONMENTAL AND SAFETY

Temperature – Operating: 0°C to +50°C; Nonoperating: –40°C to +75°C.

Humidity – Operating and Nonoperating: Up to 95% relative humidity, up to 50°C. Per MIL-T-28800E, Type III, Class 5.

Altitude, Vibration, Shock Nonoperating, Bench Handling – Meets MIL-T-28800E, Type III, Class 5.

Electromagnetic Compatibility – (with sampling heads or optional blank panels installed in all sampling head compartments) Meets the Requirements of: MIL-STD-461B; FCC Part 15, subpart J, Class A; VDE 0871/6.78 Class B.

Safety – Listed UL 1244, certified CAN/CSA C22.2 No. 231.

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
11801B				
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	599	23.6	550	21.6
SM-11				
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	558	22.0	550	21.6
Weight	**kg**	**lbs.**	**kg**	**lbs.**
11801B				
Net	22.3	49	23.2	51
Shipping	25.9	57	26.8	59
SM-11				
Net	20.0	44	20.9	46
Shipping	23.6	52	24.5	54

**1 Vertical system specifications of 11801B with SD-14 non-applicable. See 11800 Series Sampling Head specifications.*

**2 11801B external trigger requires 23 ns pre-trigger or DL 11 Delay Lines to view trigger point (45.5 ns with Option 1M).*

**3 For intervals <100 ps, the above holds for time/div ≤20 ps/div.*

**4 For other intervals not listed above, linearly interpolate the cardinal points.*

**5 Available only in statistical measurement mode.*

TIME BASE ACCURACY – TYPICAL SPECIFICATIONS

Range*3, *4	Base	+	Interval Specification	+	Position Specification
Interval ≥1 ns	4 ps		0.004%* Interval		0.0004%* Position
Interval =100 ps	2.5 ps		–		0.0004%* Position
Interval ≤10 ps	1 ps		–		0.0004%* Position

Digital Sampling Oscilloscope
11801B

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

11801B
Digital Sampling Oscilloscope.
Includes: User Manual (070-8783-00), Programmer Manual (070-8784-00), Service Manual (070-8781-00), 12 inch SMA-SMA Cable, 2 ea. 8 1/2 inch SMA-SMA Cable, 1 Wrist Strap.

Opt. 1R – Rackmount.
Includes: Hardware, tooling, and instructions for converting Bench Model to Rackmount Configuration. Available with 11801B and SM-11.

Opt. 1M – Multi-channel Conversion. Modifies 11801B to permit operation with up to four SM-11 Multi-channel Units.

SM-11
Multi-channel Unit.
Includes: Installation/User Manual (070-7048-01), Service Reference (070-7049-01), Power Cord, U.S., 120 V (161-0066-00).

DL-11
Delay Line.
Includes: Installation/User Manual (070-7050-01), Instruction Sheet (070-7051-01), 20 in. Coaxial Cable, RF 50 Ω (174-1427-00), 60 in. Coaxial Cable, RF 50 Ω (174-1428-00).

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

See Customer Information Section for additional information.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

RECOMMENDED ACCESSORIES

Also see page 438.

PROBES

50 Ω Divider (Z0) Probe – 9 GHz. Order P6150.

Active Probes (requires 1103 power supply) –
10X, DC – 1 GHz, ≥10 MΩ Input Impedance, 1.9 pF. Order P6204.
10X, DC – 4 GHz, ≥100 kΩ Input Impedance, 0.4 pF. Order P6217.
1103 Power Supply.
10X DC-1.5 GHz, ≥1 MΩ/≤1 pF. Order P6245.

Differential – 1/10X DC-1 GHz. Order P6247. (Requires 1103 Power Supply).

Current Probe – (requires BNC to SMA Adapter)
DC – 50 MHz, 0-20 A
(DC + peak AC). Order AM 503S.
DC – 100 MHz, 0-20 A. Order AM 5035 Opt. 05.
DC – 15 MHz, 0-100 A (DC + peak AC).
Order AM 503S Opt. 03.
25 kHz-1 GHz, Max Current of 0.5. A RMS.
Order CT-1.

Optical-to-Electrical Converters – (See page 338)
DC – 6.4 GHz, 1000-1700 nm.
Order SD42*[1].
DC – 20 GHz, 1200-1650 nm.
Order SD46*[1].
DC – 1 GHz, 1100-1700 nm.
Order P6703B*[2].
DC – 700 MHz, 450-1050 nm.
Order P6701B*[2].
DC – 300 MHz, 1000-1700 nm, High Gain.
Order P6713*[2].

CALIBRATION STEP GENERATOR

U.S. – Order 067-1338-00.
Includes: Instruction Sheet; Test Report; SMA Female Short-circuit Termination.

Universal European – (240 V, 50 Hz). Order 067-1338-01.

UK – (240 V, 50 Hz). Order 067-1338-02.

Australia – (240 V, 50 Hz). Order 067-1338-03.

Switzerland – (240 V, 50 Hz). Order 067-1338-05.

Japan – (100 V, 50-60 Hz). Order 067-1338-06.

CART
Order K465.

ADDITIONAL ACCESSORIES

Also see page 438.

Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01.

SMA Accessory Kit – 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-Male adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-Female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (.312, 6 point). Order 020-1693-00.

**[1] See page 338 for complete selection information.*

**2 Requires 1103 TEKPROBE® power supply for use with 11800 and CSA 800 Series.*

3.5 mm Accessory Kit – 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-Male Adapter, 1 ea. Female-to-Female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Attenuators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Attenuators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Flexible Signal Cables (2 ns, Male-to-Male), 2 ea. Signal Cables (500 ps, Male-to-Male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 ea. Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point). Order 020-1692-00.

2X Attenuator – SMA Male-to-Female. Order 015-1001-00.

5X Attenuator – SMA Male-to-Female. Order 015-1002-00.

Power Divider – Order 015-1014-00.

Blank Sampling Head – Order 200-3395-00.

ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz aberrations: ±3% max with 100 ps rise time. Order 015-0558-00.

DC Block (Coupling Capacitor) – Order 015-1013-00.

Slip-on Connector – Order 015-0553-00.

Connector Savers –
(SMA) Order 015-0549-00.
(APC) Order 015-0552-00.

DL-11 Service Manual – Order 070-7050-01.

SM-11 Service Manual – Order 070-7049-01.

CABLES AND EXTENDERS

Sampling Head Extender Cable –
1 m. Order 012-1220-00.
2 m. Order 012-1221-00.

SOFTWARE

WSTR31 – WaveStar™ waveform capture and documentation software.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Sampling Heads

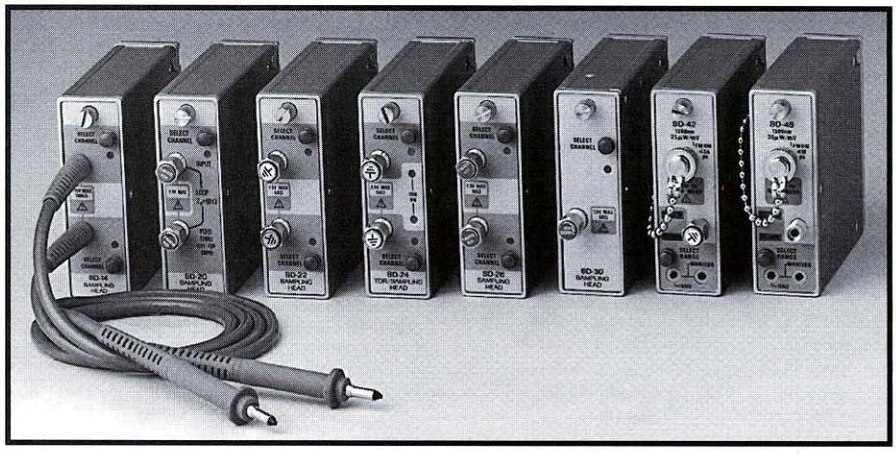
SD-14 • SD-20 • SD-22/-24/-26 • SD-32 • SD-42/-46 • SD-51

Features

SD-14
- 100 kΩ, 0.5 pF Typical
- 7 V p-p Dynamic Range
- 3 GHz Bandwidth
- ECL, CMOS and GaAs Device Characterization

SD-20
- Loopthrough Sampling Head
- Non-terminated
- General-purpose TDR

SD-22
- 12.5 GHz Bandwidth
- Low-noise
- Digital Data Communications
- Dual-channel



SD-14 High Impedance Probe Sampler

The SD-14 is a dual-channel, 3 GHz probe sampler designed for high impedance signal acquisition where a 50 Ω acquisition system is not the optimal solution. The SD-14 is ideal for high-speed device characterization such as ECL, CMOS, ACL, and GaAs testing. The 100 kΩ input impedance and 0.5 pF capacitance results in very low loading of the device under test. The 7 V dynamic range and ±3.5 V offset range, makes the SD-14 suitable for testing all digital logic families as well as most analog circuits.

The SD-14 consists of two samplers, each attached at the end of a 1.0 meter cable for easy circuit probing. The modular architecture of the CSA 803A/11801B enables the use of extended samplers, bringing a new level of performance to sampling scopes. In conjunction with the 11801B and SM-11 multi-channel unit, it is possible to configure up to 136 channels of high-impedance, high-bandwidth acquisition with measurement accuracy approaching 140 ps.

SD-14 Option 01 adds a longer probe tip, two probe-to-ECB (etched circuit board) adapters, and two probe-to-SMB adapters. These ease probing of plated holes (as found in Outboards for IC testers) and semi-permanent connections.

SD-20 Loopthrough Sampling Head

The SD-20 is a single-channel, 20 GHz loopthrough sampling head designed for low-loss testing in applications such as microwave systems research and development, digital device characterization, and high-speed digital communications circuit design. It provides an acquisition rise time of 17.5 ps, with typically 750 µV RMS of noise (350 µV with smoothing) to ensure clean, undistorted signals.

The SD-20 is non-terminated and keeps losses to a minimum by routing the signal of interest directly through the sampling head without the need of a power divider. The SD-20 can also be used for customized TDR measurements of transmission lines and controlled impedance devices. An external signal generator may be used, instead of the SD-24 step generator, to tailor the TDR stimulus to fit a particular situation. For instance, slower slew rates or higher amplitude may be utilized, or you may perform half-sine or impulse testing.

In digital communications, the SD-20 is useful for viewing and triggering on the clock signal without the use of a power divider.

SD-22 Low-noise Sampling Head

The SD-22 is a dual-channel, 12.5 GHz sampling head specifically designed for low-noise measurement in digital communications and device characterization applications. It provides an acquisition rise time of 28 ps, and typically 450 µV RMS of displayed noise. With smoothing, noise levels are 180 µV RMS.

In order to precisely capture and display the switching characteristics of high-speed communications circuits, to make accurate statistical measurements of signal noise and signal timing jitter, or to obtain stable timing measurements of fast digital ICs, the noise floor of the test equipment must be kept to a minimum. The SD-22 is the ideal instrument for these low-noise applications.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Sampling Heads

SD-14 • SD-20 • SD-22/-24/-26 • SD-32 • SD-42/-46 • SD-51

Features

SD-24
- TDR/Sampling Head
- Dual-channel, Differential TDR
- 20 GHz Bandwidth
- 35 ps Reflected Rise Time
- Line Impedance and Crosstalk Characterization

SD-26
- 20 GHz Bandwidth
- Dual-channel

SD-32
- 50 GHz Bandwidth
- Single-channel
- 2.4 mm Connector

SD-42*1
- Optical-to-Electrical Converter
- DC to 6.4 GHz Optical Bandwidth
- 1000-1700 nm Wavelength Range

SD-46*1
- Optical-to-Electrical Converter
- 20 GHz Optical Bandwidth
- 1200 nm to 1650 nm Spectral Response

SD-51
- Trigger-countdown Head
- 1 to 20 GHz Bandwidth
- Less Than 6 ps RMS Jitter

**1 For more information on this product, see the Telecommunications Products section of this catalog.*

SD-24 TDR/Sampling Head

The SD-24 is a dual-channel TDR/Sampling Head. This sampling head has a rise time of 17.5 ps or less, with a typical 20 GHz equivalent bandwidth.

Each channel of the SD-24 is also capable of generating a fast rising step for use in Time Domain Reflectometry (TDR). In TDR mode, the acquisition portion of the sampling head monitors the incident step and any reflected energy. The reflected rise time of the TDR step is 35 ps or less. The polarity of each channel's TDR step can be selected independently of the other channel. This allows for differential or common-mode testing of two coupled lines, in addition to the independent testing of isolated lines. The SD-24 can be used to characterize crosstalk by using the TDR step to drive one line while monitoring a second with the other channel.

The "filter" function on the CSA 803A/11801B can be used with TDR or crosstalk measurements to characterize a system at a slower rise time.

SD-26 Sampling Head

The SD-26 is a dual-channel, 20 GHz equivalent bandwidth sampling head. This sampling head has the same acquisition capability as the SD-24 TDR/Sampling Head but does not include the TDR step generators.

SD-32 Sampling Head

The SD-32 is a single-channel, 50 GHz bandwidth sampling head. The SD-32 performance is available for any new or existing CSA 803A/11801B mainframe. The SD-32 has measured bandwidth of greater than 50 GHz and calculated rise time less than 7.0 ps. The front-panel connector is female 2.4 mm, and an adapter is provided (011-0157-00; 2.4 mm male to 2.92 mm female) in order to maintain compatibility with SMA connector systems.

SD-42 Optical-to-Electrical Converter*1

The SD-42 Optical-to-Electrical Converter head can be used to analyze optical signals in the 1000 nm to 1700 nm wavelength range. The pulse response of the measurement system is less than 55 ps FWHM (Full-width, Half-maximum), which is equivalent to a calculated bandwidth of DC to 6.4 GHz. The electrical output on the front panel is coupled to the adjacent sampling head via the semi-rigid coaxial link provided.

The SD-42 is also equipped with an optical power meter for average power monitoring through a pair of voltage outputs on the front panel. Power from 5 nW to 5 mW can be measured.

SD-46 Optical-to-Electrical Converter*1

The SD-46 is an Optical-to-Electrical converter for use with the CSA 803A/11801B Series Oscilloscopes equipped with an SD-22, SD-24, SD-26, SD-30, or SD-32 Sampling Head. The SD-46 is linear up to 25 mW peak input with a calibrated deflection factor from 50 µW/div to 5 mW/div at 1300 nm. This head has a 25 ps optical pulse response (maximum FWHM) with the SD-24 and SD-26.

SD-51 Trigger Head

The SD-51 Trigger-countdown Head provides stable displays of signals from 1 to 20 GHz with less than 6 ps RMS jitter.

The SD-51 is a free-running tunnel diode oscillator with a front-panel control to synchronize the oscillator to a subharmonic of the input signal and the output oscillator to a subharmonic of the input signal. The output from the SD-51 is coupled to the CSA 803A/11801B Series trigger input connector. The output signal is a direct countdown of the input (and the input connector) and permits triggering by the sampling time base unit.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Sampling Heads

SD-14 • SD-20 • SD-22/-24/-26 • SD-32 • SD-42/-46 • SD-51

SAMPLING HEAD CHARACTERISTICS

	Channels	Bandwidth	Rise Time	Impedance	Noise	Applications (Typical)
SD-14	2	3 GHz (typical)	140 ps	100 kΩ/0.5 pF 0.55 pF Opt. 01	2 mV	ECL, CMOS, ACL GaAs Dev. Characterization
SD-20	1	20 GHz	17.5 ps	50 Ω unterm.	750 µV	Special TDR, Communications
SD-22	2	12.5 GHz	28 ps	50 Ω	450 µV	Communications
SD-24	2	20 GHz	17.5 ps	50 Ω	750 µV	TDR/TDT Crosstalk
SD-26	2	20 GHz	17.5 ps	50 Ω	750 µV	Device Characterization
SD-32	1	50 GHz	7.0 ps	50 Ω	1.8 mV	High Bandwidth Communications & Microwave
SD-42	1	6.4 GHz	–	–	–	Optical-to-Electrical
SD-46	1	20 GHz	–	–	–	Optical-to-Electrical
SD-51	–	20 GHz	–	50 Ω	–	Trigger Countdown Head

Characteristics

Acquisition System – SD-14, SD-22, SD-24, SD-26: dual channel; SD-20, SD-32: single channel.

Rise Time – SD-14: 140 ps; SD-20, SD-24, SD-26: 17.5 ps; SD-22: 28 ps, all from 10% to 90%.

Bandwidth – 3 GHz (typical) for the SD-14; 20 GHz for the SD-20, SD-24, and SD-26; 12.5 GHz for the SD-22; 50 GHz for the SD-32.

Dynamic Range – 1 V p-p within a ±1.6 V range for the SD-20, SD-22, SD-24, SD-32; 7 V p-p within a ±3.5 V offset range for the SD-14.

Dot Transient Response – Accuracy after calibration at operating temperature is ±5% for signals up to 0.5 V p-p. Adjustable to unity for signals up to 1.0 V p-p.

Input Impedance – SD-22, SD-24, SD-26, SD-32: 50 Ω ±0.5 Ω. SD-14 is 100 kΩ and 0.5 pF (0.55 pF for Option 01). SD-20 is not terminated and not rated.

Displayed Noise –

With unity dot response:	Maximum	Typical
SD-20, SD-24, SD-26	1.2 mV	750 µV
SD-22	800 µV	450 µV
SD-14	8 mV	7 mV
SD-32	2.3 mV	1.8 mV
With smoothing:		
SD-20, SD-24, SD-26	550 µV	350 µV
SD-22	400 µV	180 µV
SD-32	1 mV	700 µV

Aberrations (typical) (SD-20, SD-22, SD-24, SD-26 only) – The following are acquisition aberrations. 10 ns to 20 ps before step: ±3% or less. <300 ps after step: +10%, –5% or less. 300 ps to 5 ns after step: ±3% or less. 300 ps to 5 ns after step: ±4 or less (SD-20 only). 5 ns to 100 ns after step: ±1% or less. Elsewhere: ±0.5% or less.

Aberrations (typical) (SD-14 only) – <1.5 ns after step: +12%, –25%, 1.5 ns to 4 ns after step: +1%, –3%, 4 ns to 30 ns after step: ±2%. Elsewhere: ±1%.

Maximum Input Voltage – ±3 V. SD-14: ±15 V; SD-32: ±2 V.

Isolation Between Channels – 1% p-p voltage transmission from the channel driven by the 067-1338-00, to the quiescent channel (see page 107 in this catalog).

Time Coincidence Between Channels – 10 ps accuracy; <0.2 ps/°C stability.

TDR SYSTEM (SD-24 ONLY) Displayed Rise Time.

Incident – 28 ps typical, 10% to 90%, at +250 mV or –250 mV output, elsewhere ±1%.

Reflected – 35 ps or less, 10% to 90%, at +250 mV or –250 mV output.

TDR Step Amplitude – Adjustable to ±250 mV (polarity of either step may be inverted).

Time Coincidence Between TDR steps – Adjustable to less than 1 ps.

Source Resistance – 50 Ω ±0.5 Ω.

Aberrations (at ±250 mV amplitude) – The following are TDR aberrations. 10 ns to 20 ps before step: ±3% or less. <300 ps after step: +10%, –5% or less. 300 ps to 5 ns after step: ±3% or less. Elsewhere: ±1% or less.

ENVIRONMENTAL AND SAFETY CHARACTERISTICS (11801B, CSA 803A, SM-11, SD-Series Heads)

Temperature – Operating: 0°C to +50°C; Nonoperating: –40°C to +75°C.

Altitude, Vibration, Shock, Bench Handling – Operating and nonoperating: meets MIL-T-28800C, Type III, Class 5.

Safety – Listed UL 1244 (not SD-14, SD-32, SD-42, SD-46), certified CAN/CSA C22.2 No. 231.

Electromagnetic Compatibility (not SD-14) – Meets the following requirements of MIL-STD-461C: CE-03 Pt 4 Curve 1, CS-01 Pt 7, CS-02 Pt 4, CS-06 Pt 5, RE-02 Pt 7, RS-01 Pt 4, RS-02 Pt 5, RS-03 Pt 7 (limited to 1 GHz). Meets FCC Part 15, subpart J, Class A. For Germany: Meets VDE 0871/6.78 Class B. (Not all for SD-14.)

Humidity – To 95% RH at up to 50°C.

Characteristics (SD-51)

Input Signal – Frequency range is 1 to 20 GHz. Stable synchronization on signals of at least 100 mV p-p, as measured separately into 50 Ω, 5 V p-p max.

Input Characteristics – 50 Ω SMA (3 mm) connector. Open termination paralleled by 1 pF.

Trigger Output – Approximately 200 mV into 50 Ω. Jitter is 6 ps RMS or less with signals from 5 to 20 GHz; 7 ps RMS or less with signals from 1 to 5 GHz. Kickout at signal input is 180 mV peak; kickout occurs between successive samples.

Sampling Heads

SD-14 • SD-20 • SD-22/-24/-26 • SD-32 • SD-42/-46 • SD-51

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SD-14
High Impedance Probe Sampler.
Includes: Installation/User Manual (070-8286-01); Service Manual (070-8285-01); 4-post ECB Mount Ground Socket; Edge Tab Ground Socket; 10 ea. Wire-form Ground, .050 Spacing; 10 ea. Wire-form Ground, .040 Spacing; Plastic Accessories Case.
Opt. 01 – Longer Probe Tip, Probe to ECB Adapters, Probe to SMB Adapters.

SD-20
Loopthrough Sampling Head.
Includes: Installation/User Reference (070-7531-01), Service Reference (070-7528-01), Precision 3.5-mm Termination (011-0155-00), 2 SMA Short-circuit Terminations (015-1020-00).

SD-22
Low-Noise Sampling Head.
Includes: Installation/User Reference (070-7226-02), Service Reference (070-7227-02), 2 SMA Short-circuit Terminations (015-1020-00).

SD-24
Dual TDR/Sampling Head.
Includes: Installation/User Reference (070-7052-01), Service Reference (070-7053-01), SMA Short-circuit Terminations (015-1020-00).

SD-26
Dual Sampling Head.
Includes: Installation/User Reference (070-7226-02), Service Reference (070-7227-02), 2 SMA Short-circuit Terminations (015-1020-00).

SD-32
Sampling Head.
Includes: Installation/User Reference (070-8268-01); Service Reference (070-8269-01); 1 SMA Short-circuit Termination (015-1020-00); 2.4 mm Male to 2.92 mm Female Adapter (011-0157-00).

SD-42
Optical-to-Electrical Converter.
See the Telecommunication Instruments section for complete information.

SD-46
Optical-to-Electrical Converter.
See the Telecommunication Instruments section for complete information.

SD-51
Trigger Head.
Includes: Installation/User Manual (070-7338-01), Service Reference (070-7339-01), 12 in. SMA Male-to-Male (174-1364-00).

MEASUREMENT SERVICE OPTIONS
SD-14 –
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
SD-20/-22/-24/-26/-32/-42/-46 –
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
SD-51 –
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Also see page 438.
PROBES
50 Ω Divider Probes –
2 tips: 1X, 10X. 1X: 3 GHz, 50 Ω; 10X. 9 GHz, 0.15 pF/500 Ω, 1 m. Order P6150. 3.5 GHz, 1 pF/500 Ω, 10X 3 GHz, 1.1 pF/ 5000 Ω, 100X, 1.5 m. Order P6156 Opt. 25.
Optional Tips: 10X, 20X, 100X, see page 461.
Requires SMA Male-to-BNC female adapter when attached to SMA-type inputs.
Order 015-0554-00.

ADDITIONAL ACCESSORIES
Also see page 528.
2X Attenuator – SMA Male-to-Female. Order 015-1001-00.
5X Attenuator – SMA Male-to-Female. Order 015-1002-00.
75 Ω to 50 Ω Min Loss Attenuator – BNC. Order 011-0112-00.
Power Divider – Order 015-1014-00.
Blank Sampling Head – Order 200-3395-00.
SMA Accessory Kit – 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-Male Adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-Female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (.312, 6 point). Order 020-1693-00.
3.5 mm Accessory Kit – 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-Male Adapter, 1 ea. Female-to-Female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Attenuators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Attenuators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Flexible Signal Cables (2 ns, Male-to-Male), 2 ea. Signal Cables (500 ps, Male-to-Male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 ea. Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point). Order 020-1692-00.
ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz. Aberrations: ±3% max with 100 ps Rise Time. Order 015-0558-00.
DC Block (Coupling Capacitor) – BNC. Order 015-1013-00.
Slip-on Connector – Order 015-0553-00.
Connector Savers – (SMA) Order 015-0549-00. (APC) Order 015-0552-00.

CABLES AND EXTENDERS
Sampling Head Extender Cables –
(1 m) Order 012-1220-00.
(2 m) Order 012-1221-00.
Acquisition Extender – Order 067-1324-00.
Acquisition System Extender – Order 067-1323-00.
Card Cage Extender – Order 067-1267-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Multi-channel Unit Delay Line

SM-11 • DL-11 • SIU 800

Features

SM-11

- Multi-channel TDR and Simultaneous Acquisition
- Up to 136 Acquisition Channels When Connected to the 11801B Digital Sampling Oscilloscope

DL-11

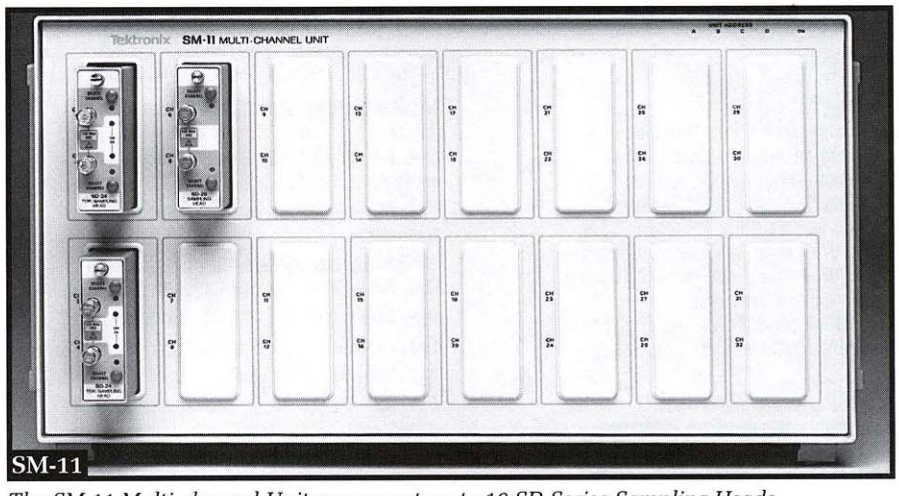
- 47.5 ns Compensated Dual Delay Line
- 5 GHz Bandwidth

CALIBRATION STEP GENERATOR

- 250 mV
- Verifies Specifications of SD-14, SD-20, SD-22, SD-24, SD-26 Sampling Heads

SIU 800

- <40 PS Reflected Rise Time When Used with SD-24
- <80 mp Reflection Coefficient



The SM-11 Multi-channel Unit can accept up to 16 SD-Series Sampling Heads.

SM-11 Multi-channel Unit

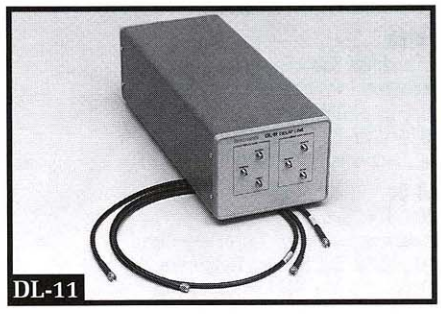
The SM-11 Multi-channel Units expand the 11801B Digital Sampling Oscilloscope to 136 channels. Each SM-11 accepts up to 16 of the SD-Series Sampling Heads; an 11801B mainframe, with Option 1M added, is capable of driving up to four SM-11 Units. The entire system can then be driven through a single GPIB address.

The 11801B/SM-11 acquisition system is designed to acquire up to 68 channels in a single acquisition. Thus, in two acquisition cycles, all 136 channels can be acquired.

The hardware measurement capability of the 11801B system allows timing measurements to be taken in a single acquisition cycle. This greatly increases the throughput of a large multi-channel system over that of a system where the signals must be multiplexed through a small number of acquisition channels and then processed in software to determine measurement results.

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	558	22	550	21.6
Weights	**kg**	**lbs.**	**kg**	**lbs.**
Net	20.0	44	20.9	46
Shipping	23.6	52	24.5	54



DL-11 Delay Line

The DL-11 Delay Line provides approximately 47.5 ns of delay from the signal input to the signal output. The DL-11 contains two delay lines that, when connected, allow you to view the triggering event through the 11801B or CSA 803A. The DL-11 has approximately 5 GHz bandwidth and attenuates the signal by 50%.

A delay line can reduce horizontal jitter and provide more accurate measurements, because it lets you take measurements on the first rising edge of the triggering event.

The DL-11 Delay Line contains two delay lines each with 47.5 ns delay. The DL-11 is used for showing the triggering event of a signal displayed on an 11801B or a CSA 803A.

PHYSICAL CHARACTERISTICS

Dimensions	**mm**	**in.**
Width	159	6.3
Height	119	4.7
Depth	356	14.0
Weight	**kg**	**lbs.**
Net	2.2	10
Shipping	3.08	14

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Static Isolation Unit/Calibration Step Generator

SM-11 • DL-11 • SIU 800

Calibration Step Generator

The Calibration Step Generator is a very fast rise time, 250 mV step generator that verifies specifications of the SD-14, SD-20, SD-22, SD-24, and SD-26 sampling heads. It is supplied with a certificate and test report, stating the rise time of the step based on a measurement-controlled, internal Tektronix acquisition standard, to a tolerance of 2.5 ps typically. This reported rise time will not exceed 19.5 ps.

The output connector is a precision 3.5 mm male that allows direct interface to the SD-Series head. The step generator is triggered directly from the Internal Clock Output on a CSA 803A/11801B Series mainframe.

SIU 800 Static Isolation Unit

The SIU 800 protects the sampling bridge from damage due to static discharge from circuit boards and cables. The SIU 800 is intended for use in applications such as TDR circuit board testing and cable testing where large static charges can be stored. When used with the SD-24 TDR/Sampling Head, the SIU 800 provides a reflected rise time of less than 40 PS and a reflection coefficient of less than 80 mp.

The SIU 800 is installed between the DUT and sampling head and is controlled manually by a foot switch or under program control through a TTL-compatible input. When the foot switch is in the normal position (not pressed), the DUT is grounded through a 50 Ω termination resistor. This will discharge any static charge stored in the DUT. Pressing the foot switch connects the DUT to the sampling head input, allowing a measurement to be made. Both channels are controlled simultaneously by the foot switch or TTL input.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	23.28	0.95
Height	71.05	2.9
Depth	91.39	3.8
Weight	**kg**	**lbs.**
Net	0.205	0.69
Shipping	0.441	2.0

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SM-11
Multi-channel Unit.
Includes: Installation/User Manual (070-7048-01), Service Reference (070-7049-01), Power Cord, U.S., 120 V (161-0066-00).

Opt. 1R – Rackmount.

INTERNATIONAL POWER PLUG OPTION
Opt. A1 – Opt. A5.
See Customer Information Section for additional description.

MEASUREMENT SERVICE OPTIONS
Opt. IN – Product Installation Service.
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

RECOMMENDED ACCESSORIES – Also see page 438.
PROBES
50 Ω Divider –
10X, DC to 9 GHz. Order P6150.3.5 GHz, 1 pF/500 Ω, 10X, 3 GHz, 1.1 pF/ 5000 Ω, 100X, 1.5 m. Order P6156 Opt. 25. Requires SMA Male-to-BNC Female Adapter when attached to SMA-type inputs. Order 015-0554-00.

ADDITIONAL ACCESSORIES – Also see page 438.
SMA Accessory Kit – 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-Male Adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-Female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (.312, 6 point). Order 020-1693-00.

3.5 mm Accessory Kit – 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-Male Adapter, 1 ea. Female-to-Female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Attenuators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Attenuators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Flexible Signal Cables (2 ns, Male-to-male), 2 ea. Signal Cables (500 ps, Male-to-male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 ea. Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point). Order 020-1692-00.

2X Attenuator – SMA Male-to-Female. Order 015-1001-00.

5X Attenuator – SMA Male-to-Female. Order 015-1002-00.

Power Divider – Order 015-1014-00.

Blank Sampling Head – Order 200-3395-00.

ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz. Aberrations: ±3% max with 100 ps Rise Time. Order 015-0558-00.

Slip-on Connector – Order 015-0553-00.

Connector Savers –
(SMA) Order 015-0549-00.
(APC) Order 015-0552-00.

CABLES AND EXTENDERS
Sampling Head Extender Cables
(1 m) Order 012-1220-00.
(2 m) Order 012-1221-00.

Acquisition System Extender – Order 067-1323-00.

Card Cage Extender – Order 067-1267-00.

DL-11
Delay Line.
Includes: Installation/User Manual (070-7050-01), Instruction Sheet (070-7051-01), 20 in. Coaxial Cable, RF 50 Ω (174-1427-00), 60 in. Coaxial Cable, RF 50 Ω (174-1428-00).

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

CALIBRATION STEP GENERATOR
U.S. – Order 067-1338-00.
Includes: Instruction Sheet, Test Report, SMA Female Short-circuit Termination.

Universal Euro – 220 V, 50 Hz – Order 067-1338-01.

United Kingdom – 240 V, 50 Hz – Order 067-1338-02.

Australia – 240 V, 50 Hz – Order 067-1338-03.

Switzerland – 240 V, 50 Hz – Order 067-1338-05.

Japan – 100 V, 50-60 Hz – Order 067-1338-06.

SIU 800
Static Isolation Unit.
Includes: 12 V DC Power Supply, Two SMA, Male-to-female Adapters, Foot Switch, Two 50 Ω Terminators, and an Instruction/Performance Verification Manual.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Interconnect Parameter Analyzer

IPA 510

Features

- Enhanced Accuracy TDR Impedance Measurements for Results to Within 1.5%
- Enhanced Accuracy Measurements Provide Time- and Frequency-domain Display Capability
- Z-Profile™ Algorithm Reduces Effects of Multiple Reflections and Improves Resolution
- Direct Readout of Inductance, Capacitance, and Impedance vs. Time
- SPICE Compatible LC Circuits, Piece-wise Linear Sources, and Composite Files with No Direct Netlist Editing Required
- Direct Graphical Comparison of Simulated and Measured Time-domain Waveforms
- Supports Extraction of Lumped, Distributed, Mixed, Coupled, and Lossy-line Models
- Powerful Waveform Math and Signal Processing Capabilities
- Base Instrument Performance (11801B): 35 ps Rise Time, Fully-differential, Multi-channel TDR
- Fixturing Support for Many Popular IC Packaging Styles
- Compatible with a Large Variety of Fixturing and Probing Stations
- Microsoft Windows Environment

Applications

- A Fully Integrated Environment for the Time or Frequency Domain:
  - Measuring
  - Modeling
  - Simulating
  - Verifying High-speed Electrical Interconnect Systems

IPA 510 with Options 28, 15 and Phaser® 200e Color Printer.

IPA 510 Interconnect Parameter Analyzer

Faster clock speeds, denser packaging, more complex systems, faster time-to-market, increased price competition. These are but a few of the parameters driving the demand for easier, faster, and more accurate electrical interconnect characterization and modeling.

By integrating the measurement, model extraction, simulation, and verification domains into a single system, the Tektronix IPA 510 Interconnect Parameter Analyzer system allows interconnect design and modeling in just minutes rather than days. With the IPA 510, you can easily optimize your design and simulate the results early in the design process – before building costly prototypes. It provides the ideal "what if..." platform to allow you to actually observe the results of various design choices with minimal time and expense.

When your design is optimized and you're ready to build a physical prototype to test real-life results, the IPA 510 is again the best tool to get the answers you need to "fine-tune" your design and get it ready for production. With a full complement of available fixturing options – from the IPA Nexus PGA-package test fixture to the PPMS-100 probe station – you can measure the actual performance of your prototype and compare it to the simulated response. Using the resultant measured parameters, you can optimize your model to produce the desired results as you commit your design to production.

As you build confidence in the IPA 510 simulation, modeling, and measurement capabilities, you can go from idea to reality with fewer design "turns", improved accuracy, and optimum quality. The result is reduced time-to-market, reduced expense, and an improved competitive position.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Interconnect Parameter Analyzer
IPA 510

With the IPA 510, you perform all steps for the development and verification of interconnect models in the familiar time domain using just one system and outputting Berkeley SPICE compatible models.

As an example, the IPA 510 measures the actual response of the interconnect via standard Time-domain Reflectometry and Transmission (TDR/TDT). Using a unique Z-Profile™ algorithm to enhance its TDR capabilities, the IPA 510 translates the response into a true impedance profile expressed in ohms.

Then, the IPA 510 automatically creates a lumped, distributed, or mixed SPICE model from the displayed Z-Profile waveform. If you want to do it manually, you can use the LCZ cursor to obtain a direct readout of the waveform's inductance, capacitance, impedance, and delay over any section of the impedance profile. In a similar manner, the IPA 510 supports Z-Profile for symmetric coupled lines enabling the accurate simulation of coupling effects.

Also, in a process similar to the above, unique Tektronix methods for extracting single-lumped, lumped coupled, asymmetric-coupled lines, and lossy transmission line models can be used and verified at the rise time of the particular logic family.

All methods use graphical dialog boxes to guide the user through the extraction processes. The SPICE netlist of these individual models and the composite model (see Figure 1) can be edited through these graphical interfaces and launched for successive simulations, enabling the immediate and direct comparison of simulated and measured results.

BEYOND TRADITIONAL TDR

Traditional TDR is effective in measuring single discontinuities; making measurements via a voltage reflection waveform is usually adequate. However, most TDR measurements of interconnects with multiple discontinuities render these traditional methods ineffective. Multiple small discontinuities which are not observable on traditional TDR can be made easily observable with Z-Profile processing. The IPA 510 Z-Profile algorithm minimizes the effects of multiple reflections and produces an output scaled in ohms. The output of the Z-Profile algorithm can be used to automatically extract lumped inductance and capacitance values for a SPICE model. To streamline manual adjustment of model values, the IPA 510 also provides

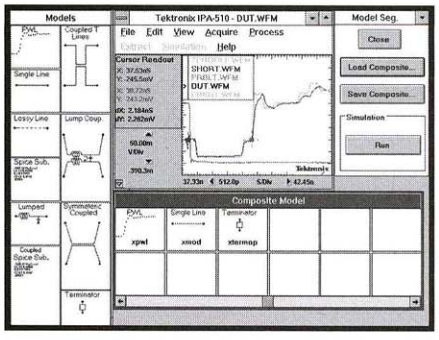


Figure 1. Composite model window.

cursors with direct readout of inductance, capacitance, and impedance. The end result is faster model development and more accurate models, verified with actual measurements.

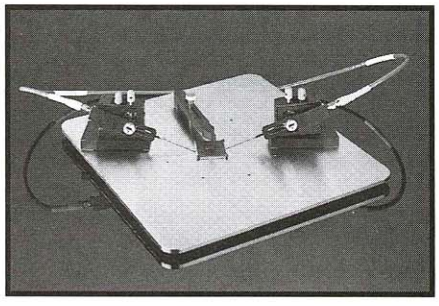
DEVICE-UNDER-TEST INTERFACES

One of the most challenging aspects of measuring high-speed digital interconnects is obtaining a reliable and high-fidelity connection to the Device-Under-Test (DUT). Measurement accuracy and repeatability depend on the clean transmission of sub-nanosecond voltage steps to and from the DUT. The IPA 510 provides a number of DUT interface options depending on the particular size and geometry of your interconnect.

- **IPA Nexus with QFP Adapter.** A precision multi-line interface to larger PGA and QFP packages.
- **Simple Coax Probe Kit.** Provides a starter kit of 12 semi-rigid, 50 Ω coax probes with the following number/inch diameter (4/0.047, 4/0.085, 4/0.141) for general use in probing ECBs and ECB-mounted connectors. These probes can easily be modified and soldered directly into circuits to meet your specific measurement requirements.
- **SMA Adapter Kit.** Provides high-performance cabling (2), simple coax probes, differential calibration tee, male/female terminations, male/female shorts, and wrenches. This kit enables standard SMA connection to DUT fixturing or probes.

Coax Positioning System

Provides very flexible probing of smaller as well as larger IC packages such as QFPs, LCCs, SOICs, and SOTs. One to four 0.047 mil diameter, 50 Ω probes can be manually positioned at one time with lead spacing down to 15-mil pitch.



AVAILABLE DUT TEST FIXTURES FOR THE NEW IPA 510

DUT Test Fixture	IC Packages	MCMs	ECBs	Connectors	Cables
Nexus + QFP	√				
Simple Coax Probe Kit	√	√	√	√	
Coax Positioning System	√	√			
SMA Adapter Kit	√	√	√	√	√

Interconnect Parameter Analyzer
IPA 510

IPA 510 System Overview

INSTRUMENT INTERFACE TYPES
- 11801A/B or CSA 803/A Digital Sampling Oscilloscope with SD-24 Dual-Channel TDR Sampling Head
- HP8510 Option 010 Network Analyzer with time-domain option (recommended only for existing HP8510 installations)

ENHANCED ACCURACY TIME DOMAIN REFLECTION/TRANSMISSION (EA-TDR/TDT)
- Higher accuracy TDR impedance measurements
- Highly repeatable user-specified TDR step rise time (30 ps typical at calibration reference plane)
- Aberrations due to source and DUT cable and connector interfaces practically eliminated
- EA-TDR/TDT data can be displayed in several network analyzer frequency domain formats from DC to 12.5 GHz
- Optional 3.5 mm calibration kit available

MODEL TYPES
- Models built from either LC and/or transmission line segments
- Lumped coupled models
- Lumped coupled LC and coupled transmission line models for simulating crosstalk
- Lossy transmission line models using standard RLC SPICE components (includes DC, skin loss, and dispersion effects)
- Automatic piece-wise linear voltage source waveforms
- Termination model to emulate actual measured response
- Automatic generation of composite SPICE files for two- and four-port interconnects with terminations
- Multiple interconnect models can be linked to simulate more complex two- and four-port interconnect networks
- Berkeley SPICE compatible subcircuits from other field solvers

PROCESSING CAPABILITIES
- Z-Profile™ for enhanced TDR resolution and true impedance profile vs. time
- Filtering to view measured and simulated response at user-specified rise time
- Waveform math includes integration, add, subtract, multiply, and divide on two waveforms
- Flip waveform for analysis of longer interconnect structures from both ends

ENHANCED ACCURACY MODE CHART

	[dB Typical]		
	<2.0 GHz	2 GHz to 5 GHz	5 GHz to 10 GHz
System Dynamic Range	70	60	50
Source Match	45	38	38
Isolation	90	80	70
Transmission Tracking	0.05	0.15	0.15

- Calculation of self-inductance, mutual inductance, total capacitance, and mutual capacitance

DISPLAY FORMATS
- Volts vs. time
- Log or linear mag vs. frequency
- Real or imaginary part vs. frequency
- Polar frequency
- Smith chart and Inverted Smith chart

CURSOR CAPABILITIES
- Volts, time, Δ V, Δ t
- Amplitude (linear, log, mag) vs. frequency, Δ amplitude, Δ frequency
- Impedance (real, imaginary, R + –jX, G + –jB), Δ impedance, Δ conductance, Δ frequency

SIMULATOR SUPPORT
- Integrated interface for simulator launch and display of output
- Supports PSPICE and Contec SPICE

USER INTERFACE
- Annotation labels for waveforms and comments
- Cut and paste waveform display for use in other applications
- Microsoft Windows environment
- Frequency-domain data savable to Touchstone exportable file format
- Time-domain data savable to file
- Complete SPICE netlists generated from high-level graphical dialogue interfaces – no direct netlist editing required

Individual IPA 510 System Component Characteristics

ENHANCED ACCURACY MODE (OPTIONS 2S, 1U, OR 2U)
Reflected Step Response –
Thru Rise Time: 30 ps ±1.5 ps.
Reflected Rise Time: 30 ps ±1.5 ps.
Aberration Thru and Reflected Aberrations:
<±1.0%, 10 ns to 20 ps before step.
<±1.5%, less than 200 ps after step.
<±0.75%, 200 ps to 100 ns after step.
<±0.75% elsewhere.
Reflected Impedance at Reference Calibration Plane: 50 Ω ±1.5%.

Displayed Frequency Domain Bandwidth – 12.5 GHz.

Test Environment – ±5°C.

IPA NEXUS CHARACTERISTICS (OPTION 28)
Number of High Speed Lines – 12.

Reflected Open Circuit Rise Time – <50 ps measured with SD-24, t_r 20 to 80%.

Electrical Length – <±20 ps delta.

Maximum Reflection at DUT – ≤±55 millirho.

DUT Connection Repeatability – <–30 dB difference between repeated connections.

QFP ADAPTER CHARACTERISTICS WHEN INSTALLED ON NEXUS (OPTIONS 29, 30, 31, 32, 33, 34)
Number of High Speed Lines – 2 or 4.

Reflected Open Circuit Rise Time – <55 ps measured with SD-24, t_r 20 to 80%.

Electrical Length – <±20 ps delta.

Maximum Reflection at DUT – ≤±55 millirho.

COAX POSITIONING SYSTEM CHARACTERISTICS (OPTION 35)
Number of High Lines – One to four 0.047 in. diameter probes.

Reflected Open Circuit Rise Time – <50 ps measured with SD-24, t_r 20 to 80%.

Maximum Reflection at SMA Connector – ≤±40 millirho.

SIMPLE COAX PROBE KIT CHARACTERISTICS (OPTION 36)
Number of High Speed Lines –
Four each 0.141 in., 0.086 in., 0.047 in. diameter probes.

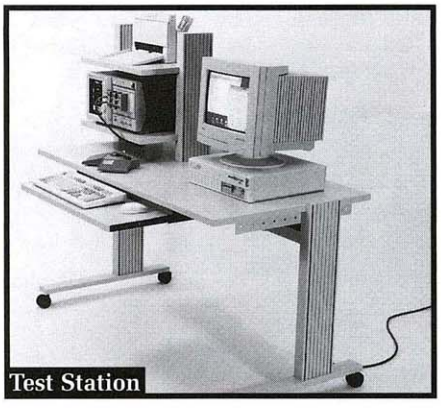
Reflected Open Circuit Rise Time – <50 ps measured with SD-24, t_r 20 to 80%.

Electrical Length (nominal) – 950 ps.

Maximum Reflection at SMA Connector – ≤±40 millirho.

Interconnect Parameter Analyzer

IPA 510


Test Station

Accessory

TEST STATION (016-1239-00)

- System Mobility and Work Space Functionality

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

IPA 510
Interconnect Parameter Analyzer.
Includes: IPA Interconnect Parameter Analyzer Software, IPA Quick Start Demo Board, Coax Adapter Kit, Torque Wrench, evaluation copy of PSPICE, and Manuals.

Analysis Software Related Options –
Opt. 2E – Add Enhanced Accuracy Coaxial Calibration Kit. Contains: Microwave Standards, 1 ea. Female and Male Open, Short, and 50 Ω Termination, Female-to-Female thru Adapter; 7.5 cm 50 Ω Reference Airline.

Add Enhanced Accuracy TDR/TDT Software (EA-TDR/TDT) – (Select one)
Opt. 2S – When Opt. 26 Selected.
Opt. 1U – For Owners of Existing 11800 Mainframes.
Opt. 2U – For Owners of Existing CSA803 Mainframes.

Add Contec SPICE Simulator Software Plus 1 Year Annual Support Fee –
Opt. 3S – US.
Opt. 4S – Europe.
Opt. 5S – Japan.
Opt. 6S – International.

Add Contec RLGC Field Solver Software Plus 1 Year Annual Support Fee –
Opt. 1F – US.
Opt. 2F – Europe.
Opt. 3F – Japan.
Opt. 4F – International.

Measurement Hardware Related Options –
Opt. 26 – Add 11801B Oscilloscope.
Opt. 27 – Add SD-24, TDR/Sampling Head.
Opt. 1E – Additional Coax Adapter Kit.
Opt. 1R – Add 11801B Rackmount Kit.
Opt. 1M – Add 11801B SM-11 Compatibility.

Fixturing Related Options –
Opt. 28 – Add IPA Nexus PGA Fixture.
Opt. 29 – Add QFP2-25 Adapter.
Opt. 30 – Add QFP4-25 Adapter.
Opt. 31 – Add QFP2-50 Adapter.
Opt. 32 – Add QFP4-50 Adapter.
Opt. 33 – Add QFP4-20 Adapter.
Opt. 34 – Add QFP4-15 Adapter.
Opt. 35 – Add Coax Positioning System.
Opt. 36 – Add Simple Coax Probe Kit.

System Integration Options –
Opt. 1S – Add System Integration and Computer. Not Available in Europe.
Opt. 02 – Add NEC SVGA 17 in. Display.
Opt. 03 – Add NEC SVGA 15 in. Display.
Opt. 1C – Add Test Station Table.
Opt. 1G – Add S3FG220 GPIB Card/Cable.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

RECOMMENDED ACCESSORIES
SD-14 Sampling Head –
2.5 GHz High-impedance (100 kΩ/0.47 pf) Dual-channel Probe Sampler.

SD-20 Sampling Head –
20 GHz Single-channel Loop-through Sampling Head.

SD-22 Sampling Head –
12.5 GHz Dual-channel Low-noise Sampling Head.

SD-26 Sampling Head –
20 GHz Dual-channel Sampling Head.

SD-32 Sampling Head –
50 GHz Single-channel Sampling Head.

SIU 800 Static Isolation Unit –
Input Protection Relay.

1 Meter Sampling Head Extender Cable –
Order 012-1220-00.

2 Meter Sampling Head Extender Cable –
Order 012-1221-00.

Color Printer – Tektronix Phaser® 200 or 300 Series Color Printer.

Coax Adapter KII – Order 020-2122-00.

Test Station – Order 016-1239-00.

AT-GPIB Card and Software – Order S3FG220.

RLGC SW –
U.S. – Order 063-2274-00.
Euro – Order 063-2350-00.
Japan – Order 063-2351-00.
ROW – Order 063-2352-00.

CONTEC SPICE – U.S. – Order 063-2273-00.
Euro – Order 063-2349-00.
Japan – Order 063-2353-00.
ROW – 063-2354-00.

Adapters –
QFP2-25. Order 015-0653-00.
QFP4-25. Order 015-0653-01.
QFP2-50 Order 015-0653-02.
QFP4-50. Order 015-0653-03.
QFP4-20. Order 015-0653-04.
QFP4-15. Order 015-0653-05.

EA-TDR/TDT Cal. Kit – Order 020-2129-00.

Coax Probe Positioning System –
Order 020-2123-01.

Coax Probe Kit – Order 020-2124-01.

IPA Nexus Fixture – Order 067-1438-00.

Note: To add EA-TDR/TDT Option at a later date, contact Tektronix service request quote for Options 1U and 2U.

RECOMMENDED ACCESSORIES
Articulated Arms –
For complete information see page 477.

Contact Tektronix Account Manager for name and location of local printer distributor.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

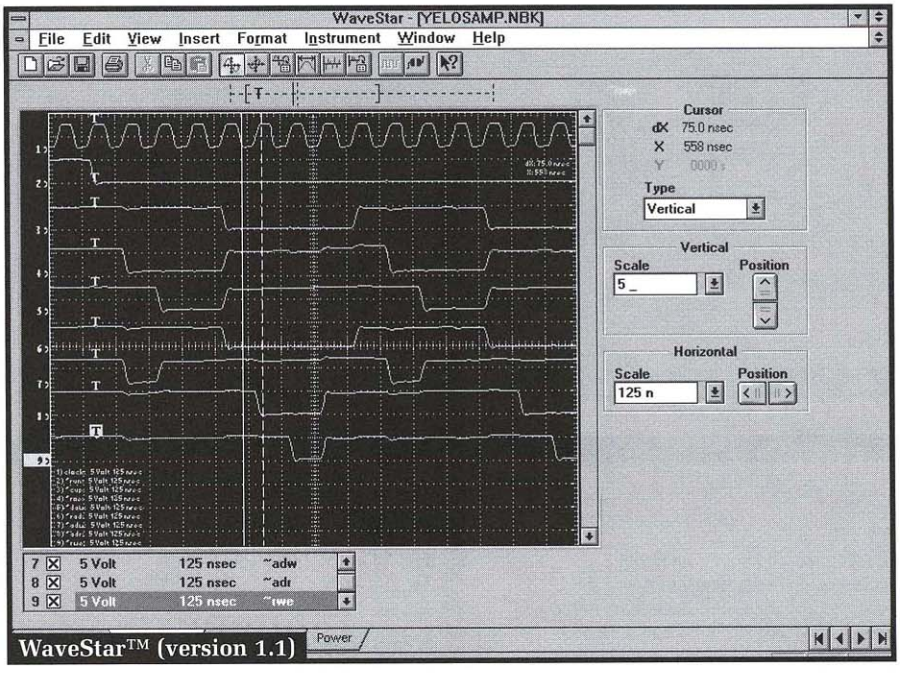
See Tektronix on the World Wide Web: http://www.tek.com

Electronic Lab Notebook Software

WaveStar™ (version 1.1)

Features

- Capture Waveforms and Settings From Digital Storage Oscilloscopes
- Annotate, Organize, and Analyze Data
- Perform Harmonic Analysis up to 51 Harmonics
- Display Table of 22 Measurements
- Store Waveforms, Pictures, Settings, and Notes
- Read TDS Floppies
- Exchange Waveforms and Data With Other Windows Application Software
- Restore Waveforms and Settings to Digital Storage Oscilloscopes
- Windows 3.1 Application
- Operation Has Been Verified Under Windows 95



PC Software Creates An Electronic Lab Notebook

WaveStar Software version 1.1 is an enhanced Windows application program from Tektronix that allows the user to quickly create an electronic lab notebook within their personal computer to record Tektronix Digital Storage Oscilloscope (DSO) measurements. The notebook can capture waveforms and/or screen shots, related scope settings, and notes. Further, WaveStar Software provides a simple link to spreadsheet and documentation software, enabling users to analyze measurement records or incorporate them within other published materials.

Version 1.1 adds new, powerful features including:

- **Harmonic Analysis** which provides a powerful tool to compute up to 51 harmonics of voltage, current, or power waveforms at the touch of an icon button. Results are presented in either graphical or tabular form.
- **Measurement Table** which displays 22 different measurements made on a selected waveform at the touch of an icon button. If multiple waveforms are selected, the results are displayed in a side-by-side columnar format, greatly facilitating comparison and analysis.
- **File Import from TDS Floppies** allows previously saved bitmap (.bmp) and waveform (.isf and .wfm) files to be read from TDS floppies.
- **File Export in Spreadsheet Format** allows data to be exported in .csv and .xls format for analysis using other software tools.

WaveStarSoftware defines one complete, unique electronic notebook as one saved file. Each notebook consists of one or more sheets. A sheet is used to record an individual measurement, capture a DSO screen shot, save DSO settings, or record notes about the experiment. There are four types of sheets:

- **Waveforms** can be viewed as plots (graphs, etc.) or as a set of data (displayed in numeric format). One or more waveforms can be captured from one or more DSOs and displayed on DSO-like graticules for visual or numerical analysis. Waveforms can be exported as .csv or .xls files.
- **Pictures** are images that are generally screen captures from a connected instrument. Stored in bitmap (.bmp) format.
- **Settings** are sent by/to the oscilloscope as a response to a DSO command (e.g., SET). Stored in readable text format, but cannot be edited.
- **Notes** are text files for users to add annotations to their acquisition record.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Electronic Lab Notebook Software

WaveStar™ (version 1.1)

WaveStar Software can open one or more notebooks simultaneously. Waveforms, DSO settings, DSO screen shots, and notes can be copied from one sheet to another or from one notebook to another. Waveforms and settings can be restored to the DSO.

WaveStarSoftware uses the Windows Clipboard to exchange waveforms and data with other Windows software such as word processors, spreadsheets, and databases. For example, a screen shot bitmap picture contained in a WaveStar Software file can be transferred to Microsoft Word 6.0 using the Clipboard.

Waveform data can be viewed in graphical form, or as a list of numbers in tabular form. Waveforms in graphical form can be copied and pasted into word processing documents to write reports, prepare user manuals, or prepare service documentation. Waveforms in tabular form can be copied and pasted into spreadsheets for custom numerical analysis.

Frequently used functions can be directly accessed through controls on the main screen and the menu bar.

WaveStar Software can acquire data from most Tektronix DSOs and can be used with either the RS-232C or National Instruments GPIB 488.2 communication options.

WaveStar Software will run on an IBM PC-compatible 386 PC with a minimum of 4 MB of RAM and 5 MB of available hard disk space. However, an IBM PC-compatible 486 or greater is recommended.

Characteristics

Instrument Interface Support – GPIB or RS-232 interfaces with full Talk-Listen modes.

Windows Clipboard – Copy/paste through Windows Clipboard to other Windows applications as bitmaps or metafiles.

Printer/Plotter Support – Uses standard Windows printer drivers supplied by printer vendor.

Waveform Export Format – Microsoft Excel 4.0 compatible.

MINIMUM COMPUTER CONFIGURATION

Type – IBM PC-Compatible 386 (486 or greater recommended).

Operating System – Windows 3.1 or later in 386 Enhanced mode.

RAM – 4 MB or greater.

Hard Disk – 5 MB free space.

Floppy Disk – One 3.5 in. high-density disk drive.

Monitor – VGA or better.

Interface Card (DSO must have appropriate interface installed) –
GPIB: National Instruments IEEE-488 Interface Card.
RS-232: One free RS-232 port.

TEKTRONIX DIGITAL STORAGE OSCILLOSCOPES SUPPORTED

WaveStar Software can acquire waveforms from the following scopes:

Instrument	GPIB/RS-232	Restore*1	Settings*1	Picture*1
11401, 11402/A, 11403/A, 11801/B, 11802, CSA404, CSA803/A, DSA601/A, DSA602/A	Both	Yes	Yes	No
2212, 2216, 2430/A, 2432/A, 2440	GPIB	Yes	Yes	No
2220, 2221A, 2230, 2232	Both	Yes	No	No
TDS 200/300 Series	Both	Yes	Yes	Yes
TDS 400, TDS 500, TDS 600, TDS 700, TDS 800 Series	GPIB	Yes	Yes	Yes
THS700 Series	RS-232	Yes	Yes	Yes

**1 Restore waveforms acquire/restore settings, acquire picture. WaveStar Software acquires waveforms from ALL scopes listed above.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

WSTR31
WaveStar Software version 1.1 for Windows 3.1
Includes: 3.5 in. Disk, Manual (070-9785-01).

WSTR31U
DocuWave® Software Upgrade to WaveStar Software version 1.1 for Windows 3.1
Includes: 3.5 in. Disk, Manual (070-9785-01).
NOTE: WSTR31U will not install on PC if DocuWave Software is not already installed.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Tektronix Measurement products are manufactured in ISO registered facilities.

Logic Scope
TLS 216

Features

TLS 216

- 2.5 pF, 1 MΩ Podlet Style FET Probes
- Display Modes: Analog, Timing Diagram and BusForm™
- <±100 ps Timing Resolution
- 16 Input Channels
- 2 GS/s Simultaneous Sampling on All Channels
- 500 MHz Real-time Bandwidth
- Logic Family Presets for TTL, ECL and CMOS
- Sophisticated Time Qualified Triggering with Four Word Recognizers
- 3-Year Warranty

BENEFITS

- Facilitates Hands-free Connection to SMT Devices
- Low Capacitance Probe for Non-intrusive Probing
- Powerful Triggering Reduces Time to Identify Problems
- Flexible Display Modes Simplify Recognition of Timing Faults
- High-speed Acquisitions on All Channels Facilitate Analysis of Complex System Interactions

Applications

- Hardware Performance Verification
- Multi-channel Data Acquisition
- Mixed Signal Analysis
- A/D and D/A Analysis
- Hardware Timing Analysis

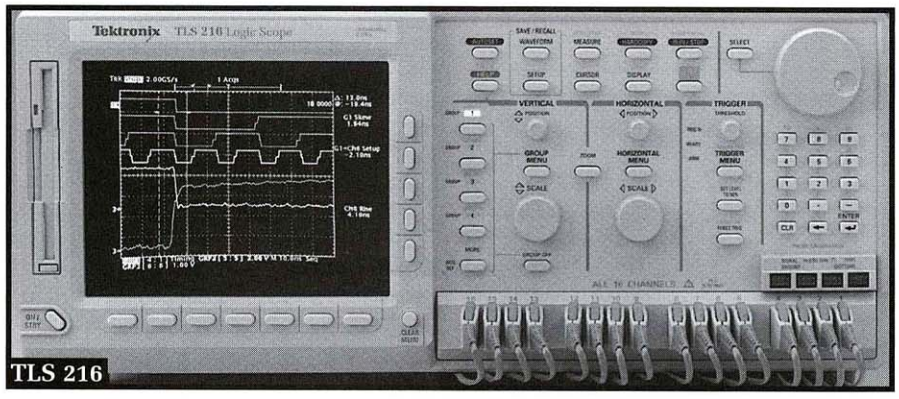
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*



TLS 216 Logic Scope

The TLS 216 Logic Scope is a new class of instrument designed to simplify the task of debugging digital hardware. The Logic Scope seamlessly combines in a single instrument the analog acquisition system of a high-speed digital storage oscilloscope (DSO) with the triggering and display systems of a logic analyzer. The 500 MHz bandwidth Logic Scope samples all channels simultaneously at 2 GS/s and has sophisticated time-qualified triggering, a high resolution color display, and an integrated MS-DOS compatible 3.5 inch floppy disk drive.

SOPHISTICATED TRIGGERING TO IDENTIFY COMPLEX DIGITAL PROBLEMS

In addition to edge trigger, most digital signals can be easily captured using pulse, glitch and pattern triggers. The Logic Scope provides two new trigger resources that allow the instrument to directly trigger on common digital circuit behavior. The industry's first time-interval or sequence trigger type monitors the time between two events, allowing the instrument to easily trigger on setup time violations, hold-time violations, or unexpected propagation delay. The powerful "Time-out" trigger type can be used to capture incomplete handshake sequences or to trigger the instrument when the DUT "hangs."

All of these trigger types let developers identify channel-to-channel relationships, including 16-Bit patterns and time-related/time-qualified system faults. The Logic Scope's external trigger-input can be used as a "Trigger Arm" to enhance cross-triggering between two instruments, simplifying the task of using a Logic Scope with other test equipment.

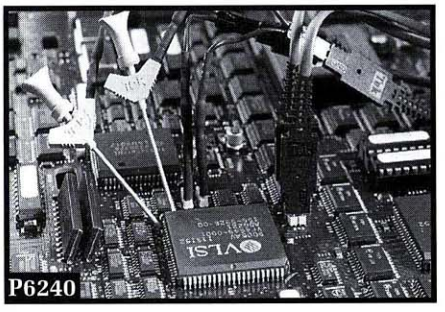
2.5 pF, LOW-MASS FET PROBES ENSURE NON-INTRUSIVE CONNECTION

The Logic Scope includes a set of 16 specially designed probes that have extremely low probe-tip mass (1.5 grams) and input capacitance (2.5 pF). The low probe-tip mass ensures that connections made to surface mount and fine pitch ICs will be reliable. The low input capacitance, combined with the 1 MΩ input resistance, decreases the effect of the probe on the DUT's operation, allowing very accurate measurements to be made with confidence.

These characteristics are made possible by using a "podlet-style" probe-tip design instead of the "pencil-style" design of traditional oscilloscope probes. Employing the de facto industry standard of 0.1 inch spacing between the signal and ground inputs, each 0.1 inch thick podlet can directly attach to the hundreds of readily available IC adapters and clips.

Logic Scope
TLS 216

Accessories



Characteristics

SIGNAL ACQUISITION SYSTEM

Sample Rate	2 GS/s
Bandwidth	500 MHz
Channels	16
Samplers	16
Sensitivity	50 mV to 10 V/div*[1]
Position Range	±5 Div
Offset	±1 V from 1 to 99.5 mV/div

[1] Magnification used above 2 V/div range.

VERTICAL SYSTEM

DC Gain Accuracy – ±1.5% after probe calibration.

Vertical Resolution – 8-Bits (256 levels over 10.24 vertical divisions), 11-Bits with averaging.

Analog Bandwidth Selection – 20 MHz and full.

Input Coupling – DC.

Input Impedance – 50 Ω with coax adapter, 1 MΩ with probe.

Maximum Input Voltage – Max non-destructive input ±25 V (DC + Peak AC).

Dynamic Range – +15 V to –12 V with probe.

TIME BASE SYSTEM

Time Bases	Main, Delayed
Time/Division Range	500 ps to 5 s/div
Time Base Accuracy	0.01% over any interval ≥1 ms
Record Length	500 to 2,000 pts
Pre-trigger Position	20% to 80% of record

ACQUISITION MODES

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform averages selectable from 2 to 10,000.

DISPLAY

Mixed-mode Data Display – Logic Scope offers Analog, Timing, and BusForm™ display formats that simplify recognition of digital timing faults and signal anomalies. BusForm display compresses many input signals into the least amount of display area. The acquired data can be displayed in any of the three display modes without re-acquiring.

Waveform Style – Dots, vectors, variable persistence selectable from 250 ms to 10 s, infinite persistence, and intensified samples.

Color – Standard palettes and user definable colors for waveforms, text, graticules, and cursors. Measurement text and cursor colors matched to waveform. Waveform collision areas highlighted with different color. Statistical waveform distribution shown with color grading through variable persistence.

Color Grading – With variable persistence selected, historical timing information is represented by temperature or spectral color scheme providing "z-axis" information about rapidly changing waveforms.

Graticules – Full, grid, cross hair, frame.

Format – YT.

Fit to Screen – Entire acquisition memory displayed on screen.

TRIGGERING SYSTEM

Triggers – Main, Delayed.

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delayed by time and/or events.

Time Delay Range – 16 ns to 250 s (time/div ≤10 µs); 15.1 ns to 250 s (time/div ≤25 µs).

Events Delay Range – 1 to 9,999,999 events.

AUX Trigger Input – TTL compatible; Max input voltage is –1 V to +6 V.

MEASUREMENT SYSTEM

The Logic Scope provides a comprehensive suite of automatic measurements specifically designed to improve efficiency when troubleshooting digital hardware. Twenty-eight onboard measurements, including setup time, hold time, and skew, speed identification of common digital problems. Whereas traditional DSOs confine waveform measurements to establishing the relationship of a single channel to a clock, the Logic Scope simultaneously samples on all channels, so you can see the relationships between multiple channels.

Automatic Waveform Measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+ Duty Cycle	– Duty Cycle
+ Overshoot	– Overshoot
Propagation Delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Phase	Setup Time
Hold Time	Skew

Continuous update of up to four measurements on any combination of waveforms.

Gated – Any region of the record may be isolated for measurement using vertical bars.

Snapshot – Performs all measurements on any one waveform, showing results from one instant in time.

Cursor Measurements – Absolute, Delta; Volts, Time, Frequency, Binary Readout.

Cursor Types – Horizontal bars (volts); Vertical bars (time); operated independently or in tracking mode.

COMPUTER INTERFACE

GPIB (IEEE 488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARD COPY/DESKTOP PUBLISHING

Printer – HP ThinkJet, Epson, PostScript, DeskJet, LaserJet, DPU 411/412.

Export File Formats – EPS (Encapsulated PostScript), Interleaf, TIFF, PCX, BMP, RLE.

Plotter Support – HPGL.

I/O Ports – GPIB, Centronics, RS-232 (Talk only).

Floppy Disk Drive – 3.5 in., 1.44 MB DOS format.

VGA Output – 15-Pin analog output (Color).

STORAGE

Waveforms – 16 full 2,000 pt waveforms. 119,008 500 pt waveforms on 1.44 MB floppy disk.

Setups – 10 front-panel setups. 78,947 setups on 1.44 MB floppy disk.

Logic Scope
TLS 216

TRIGGER TYPES (MAIN AND DELAYED)

Edge	Trigger when either a rising or falling edge (positive or negative slope) is detected.
Pulse	The pulse may be positive or negative and defined by a duration.
Width (<Time, >Time)	Trigger when the duration of either a positive or negative pulse is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration of either a positive or negative pulse is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the trailing edge of either a positive or negative pulse is not detected.
Pattern	Each input may be defined as a low (logic 0), high (logic 1), or don't care (X). Inputs can be ANDed or ORed. The pattern may be positive true or positive false.
Width (<Time, >Time)	Trigger when the duration of a user-defined logical pattern is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration of a user-defined logical pattern is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the user-defined logical pattern of a specified duration does not occur.
Sequence	The sequence is defined by a set of start and end events. The start or end event can be either a pattern or an edge (positive or negative slope).
Width (<Time, >Time)	Trigger when the duration between the user-defined start and end events is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration between the user-defined start and end events is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the user-defined end event does not occur within the specified time after the start event.
State	Trigger when a user-specified logical pattern is detected and the input defined as the clock goes true or goes false. Each input may be specified as a low (logic 0), high (logic 1), or don't care (X). Inputs can be ANDed or ORed.

POWER REQUIREMENTS

Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 47 to 63 Hz.

Power Consumption – 300 W max.

ENVIRONMENTAL AND SAFETY

Temperature – Operating: +4°C to +50°C. Nonoperating: –22°C to +60°C.

Humidity – Operating and Nonoperating: Operating to 80% at or below 29°C, to 20% from +30°C to +50°C. Nonoperating to 90% at or below 41°C to 5% from +41°C to 50°C.

Altitude – Operating: 15,000 ft., Nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve # 1; meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart B, Class A.

Safety – Listed UL 1244, certified CAN/CSA C22.2 No. 231-M89.

PROBES

Active Probes – 2.5 pF, 1 MΩ FET.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height with feet	236	9.3
without feet	193	7.6
Width with handle	445	17.5
Depth with front cover installed	432	17.0
Weight	**kg**	**lbs.**
Net ≈	12.3	27
Shipping ≈	20.0	44

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TLS 216
Logic Scope.
Includes: 16 each P6240 2.5 pF, FET Probes, 2 each Handheld Adapters (013-0281-00), 2 each 7 in. Ground Leads (196-3302-00), 2 Packages of 10 each Y-leadsets (020-2008-00), 3 Packages of 12 each KlipChip™ (020-1386-01), 2 each 2-to-1 Podlet Adapters (013-0280-00), 1 Package of 6 Probe Cable Looms (352-0139-00), 3 Cards of Channel ID Labels (334-8632-00), Instrument Front Cover (200-3696-00), U.S. Power Cord (161-0230-01), Quick Reference Guide (070-8833-00), User Manual (070-8834-00), Programmer Manual (070-8835-00).

Opt. 1B – Package of 16 50 Ω Coax Adapters.
Opt. 1K – K420 Instrument Cart Without Power Strip.
Opt. 1R – Rackmount Kit.
Opt. 1S – Substitute 16 Coax Adapters for Standard Probes.
Opt. 24 – Four Extra P6240 Probes.
Opt. 3I – Phaser® 140 360 dpi Color Ink-jet Printer (220 V).
Opt. 3P – Phaser® 140 360 dpi Color Ink-jet Printer (110 V).
Opt. 95 – Calibration Data Report.
Opt. 96 – Calibration Certificate.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

MEASUREMENT SERVICE OPTIONS

Opt. IN – Product Installation Service.
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R5 – Repair warranty extended to cover five years.
Opt. S3 – Three year upgrade to "On-site" Service.
Opt. S5 – Five year upgrade to "On-site" Service.

PROBES

FET Probes Only – 2.5 pF, 1 MΩ, 800 MHz, 20X, 1.5m. Order P6240.

CARTS

Instrument Cart – Order K420.

ADDITIONAL ACCESSORIES

Also see page 438.

Service Manual – Order 070-8836-00.
Soft Carrying Case – Order 016-0909-01.
Hard Transit Case – Order 016-1157-00.
U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

Logic Analyzers
and Digital Analysis Systems

TLA 700 Series

A New Family of Instruments

The TLA 700 Series is a new family of instruments developed specifically to address the fast-changing needs of today's digital design engineers. These products bring new technology to bear on the time and design pressures faced by digital system designers.

The family consists of portable and benchtop mainframes, logic analyzer modules, DSO modules, and a full line of complementary support products for popular microprocessors and buses.

TLA 700 SERIES LOGIC ANALYZER MODULES

The TLA 700 Series includes a wide selection of logic analyzer modules with measurement capabilities not seen in logic analyzers before.

MagniVu™ ACQUISITION TECHNOLOGY – A BREAKTHROUGH FOR LOGIC ANALYZERS

At the heart of all of the TLA 700 Series logic analyzer modules is a breakthrough called MagniVu acquisition technology. MagniVu acquisition technology is a super-high-speed sampling architecture that dramatically changes the way logic analyzers work and what functionality they offer.

TLA 510 and TLA 520

The TLA 500 Series offers mid-priced logic analysis at performance levels previously available only in high end system analysis tools. The TLA supports the most advanced high-speed RISC/CISC microprocessors and multiple microcontroller embedded systems. The Tektronix Power*Flex*™ capability allows the TLAs to grow in capability as the testing demands increase.

The TLA Series provides acquisitions at depths from 8 K to 8 MB sequences. The TLA 510 has 100 channels of acquisition with an optional pattern generator. The TLA 520 has 150 or 200 acquisition channels. The X-window style interface is available on a standard 15-inch or optional 17-inch terminal.

Also available is off-line analysis of acquired data (LA-OffLine™) and the latest advancement in logic analysis – source code tracing with LA-Browser™.

The Enterprise Digital Analysis System – DAS® NT

The global effort toward "Enterprise Computing" centers on efficient exchange and reuse of data across multiple tool sets. To this environment Tektronix brings the DAS NT Digital Analysis System as enterprise instrumentation. A fully networked real-time analysis system that supports both software and hardware design and optimization. The workstation-based interactive interface provides control, data presentation and automated data exchange with other design tools such as logic simulators and compilers.

The DAS NT Digital Analysis System is the unrivaled performance leader in the analysis of complex digital systems. The DAS NT has super deep memory of up to 8 M per channel, up to 1536 channels of 100 MHz synchronous acquisition, pattern generation, high-speed timing, support for multiple microprocessors, the most intelligent disassembly available, links to high level debug tools and languages, and is networked to your X-Window based workstation for easier and faster operation.

Also available is off-line analysis of acquired data (LA-OffLine) and the latest advancement in logic analysis – source code tracing with LA-Browser.

DAS XP Digital Analysis System

The DAS XP Digital Analysis System provides much of the capability of the DAS NT system in a standalone environment. A Tektronix X terminal provides the same X-Window interface as the DAS NT and can be independent of any network.

CONTENTS

LOGIC ANALYZERS

TLA 700 120
TLA 510 131
TLA 520 131
DAS® Digital Analysis System 135
LA-Browser 139
LA-OffLine™ 140
92PORT 141
92LANP 141
Software Support 141
Microprocessor Support 142

ACCESSORIES

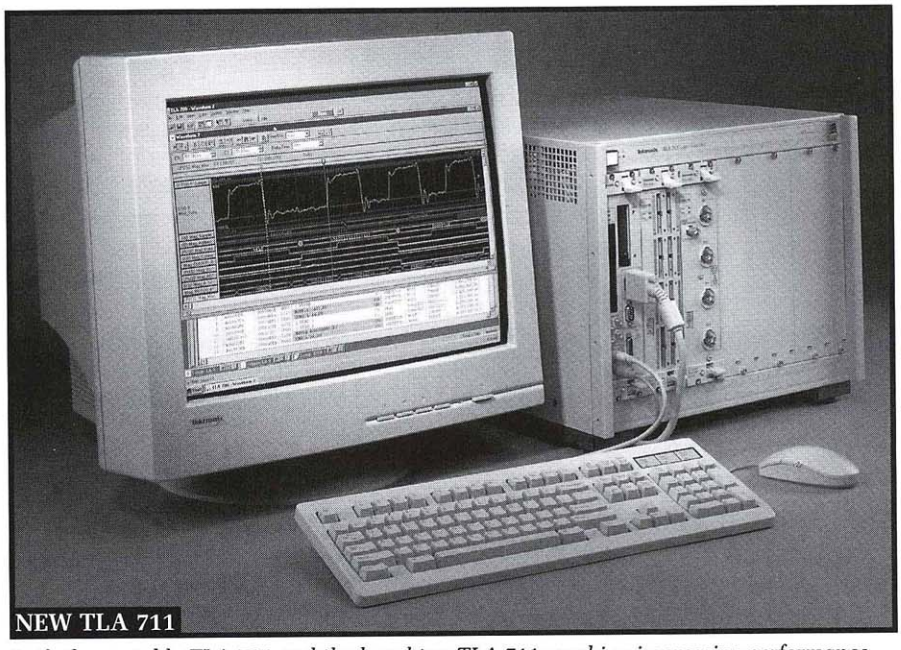
Probes 438
Carts 524

Logic Analyzers
New TLA 700 Series

Features

- MagniVu™ Acquisition Technology Provides 2 GHz Timing Resolution on all Channels
- 200 MHz State Acquisition
- Simultaneous State and Timing Analysis Through the Same Probes
- User-selectable Setup-and-hold Window
- Precise Triggering on Setup-and-Hold Violations and Glitches
- Broad Range of Microprocessor Support
- Four Channel 5 GS/s 1 GHz DSO
- DSO Triggers on Edge, Pulse Width, Timeout, Glitch, Runt Pulse, Slew Rate, Logic, or Setup and Hold Time
- Portable and Benchtop Mainframes
- All Modules, Software, and Accessories Fully Interchangeable Between Mainframes
- Compatible with Standard PCMCIA Plug-and-play Accessories
- Microsoft Windows 95 Operating System

Designed for Microsoft Windows 95



Both the portable TLA 704 and the benchtop TLA 711 combine impressive performance and a modern graphical user interface to simplify debugging complex system problems and enable engineering teams to meet or beat their development schedules.

A New Family of Instruments

The TLA 700 Series is a new family of instruments developed specifically to address the fast-changing needs of today's digital design engineers. These products bring new technology to bear on the time and design pressures faced by digital system designers.

The family consists of portable and benchtop mainframes, logic analyzer modules, DSO modules, and a full line of complementary support products for popular microprocessors and buses.

TLA 700 SERIES LOGIC ANALYZER MODULES

The TLA 700 Series includes a wide selection of logic analyzer modules with measurement capabilities not seen in logic analyzers before.

MagniVu ACQUISITION TECHNOLOGY – A BREAKTHROUGH FOR LOGIC ANALYZERS

At the heart of all of the TLA 700 Series logic analyzer modules is a breakthrough called MagniVu acquisition technology. MagniVu acquisition technology is a super-high-speed sampling architecture that dramatically changes the way logic analyzers work and what functionality they offer.

All incoming data is oversampled at a 2 GHz rate, regardless of how the logic analyzer is being used. The oversampled data is then processed in real time to perform timing acquisition, state acquisition, and triggering without missing the slightest piece of crucial timing information on any channel.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Logic Analyzers
New TLA 700 Series

MagniVu™ Acquisition technology makes it possible to offer the following measurement capabilities that logic analyzer users have long needed:

500 ps Timing Resolution on All Channels. By storing timing information in MagniVu acquisition technology's high-speed memory at the full 2 GHz rate, all TLA 700 Series logic analyzers are able to offer 500 ps timing resolution on all channels.

Up to 200 MHz State Acquisition. TLA 700 Series modules offer standard configurations with state acquisition up to 100 MHz for common applications and optional 200 MHz configurations for leading-edge applications.

Since all clocks and data are oversampled at a 2 GHz rate and processed in real time to provide 200 MHz synchronous acquisition, each data sample is timestamped with 500 ps resolution.

User-selectable Setup-and-hold Window. Because TLA 700 Series logic analyzers always oversample incoming data at a 2 GHz rate, they are able to provide unmatched state acquisition capabilities as well. The combined setup-and-hold time window required across up to 136 channels is typically only 2.0 ns and can be placed anywhere from 8.5 ns before the selected clock edge to 7.0 ns after the clock edge, in 500 ps increments.

If your design involves sections of circuitry with different timing requirements or even mixed logic families, that's no problem for the TLA 700 Series; you can set different setup-and-hold time characteristics and unique threshold settings for different groups of channels.

NEW TLA 704

Simultaneous State and Timing Analysis Through the Same Probes. The logic analyzer modules are able to provide both timing analysis and state acquisition simultaneously. They provide 500 ps timing AND up to 200 MHz state acquisition at the same time, through the same probes.

You no longer have to hook up a second set of probes and timing modules to a bus you're already acquiring state data from. No more running out of timing channels because you didn't have enough modules or couldn't fit them into your mainframe. No tradeoffs of channels or important features to get the results you need.

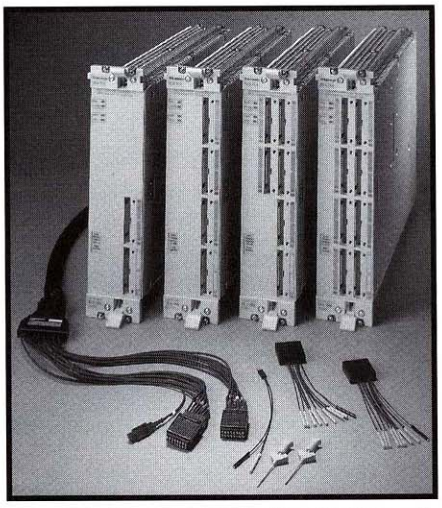
Precision Triggering on Setup-and-hold Violations and Glitches. Each logic analyzer module has the ability to trigger on very precise timing problems. Whether timing problems are suspect, or things seem to be working and you need to test for design margins, the TLA 700 Series triggering does what no other logic analyzer can.

The TLA 700 Series can trigger on setup-and-hold time violations on any or all groups of channels with 500 ps resolution. You can select different timing limits for different groups and even verify propagation delay from clock-to-output of synchronous circuits.

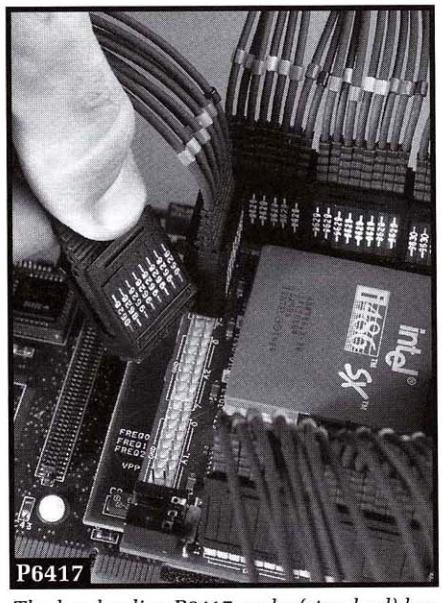
Logic Analyzers
New TLA 700 Series

Not even glitches can escape the watchful eye of the TLA 700 Series; because the glitch detection logic is processing the same oversampled data. ANY set of two or more transitions between sample points on any channel is captured and can be used for glitch triggering.

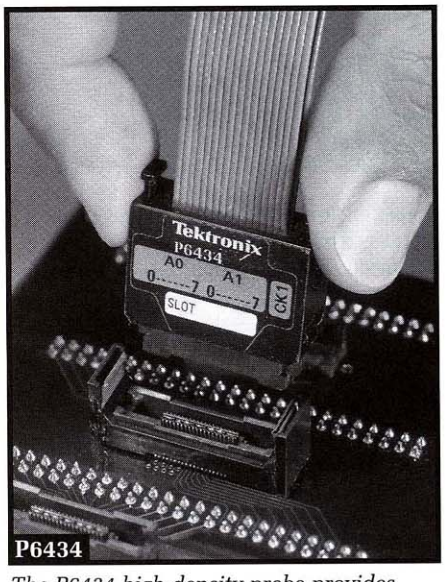
What-You-See-Is-What-You-Triggered-On!
The greatest benefit that oversampling brings to triggering is that the precise timing of whatever condition you trigger on is fully visible with MagniVu™ technology. This means that when you trigger on a setup-and-hold time violation on a 64-Bit data bus, you can immediately view all 64 channels to see exactly which signals caused the violation and how far those signals were beyond the limits you specified.



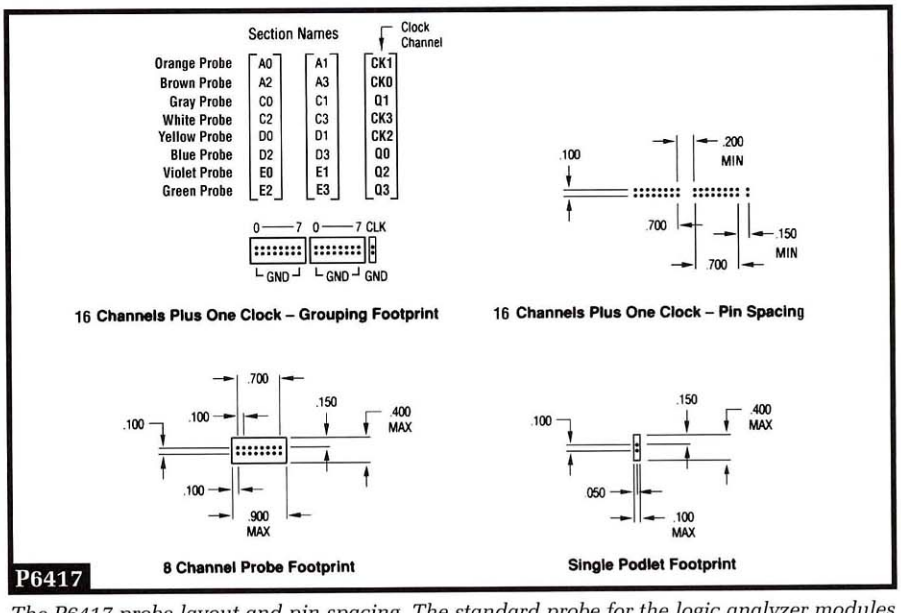
From left: The 34-CH, 68-CH, 102-CH, and 136-CH Logic Analyzer modules; available with depths up to 512 K per channel. A TLA 711 benchtop mainframe can hold up to five modules for a total of 680 channels.



The low loading P6417 probe (standard) has an input capacitance of approximately 2 pf.



The P6434 high-density probe provides convenient connection for 34 channels with an optional latching mechanism and a capacitive loading of only 2 pf per channel. It uses only about one-fourth the surface area required by conventional logic analyzer probes; the entire footprint of the connector and latch is only 0.400" x 1.250".



The P6417 probe layout and pin spacing. The standard probe for the logic analyzer modules is compatible with existing test fixtures and probe adapters for microprocessor support.

Logic Analyzers
New TLA 700 Series

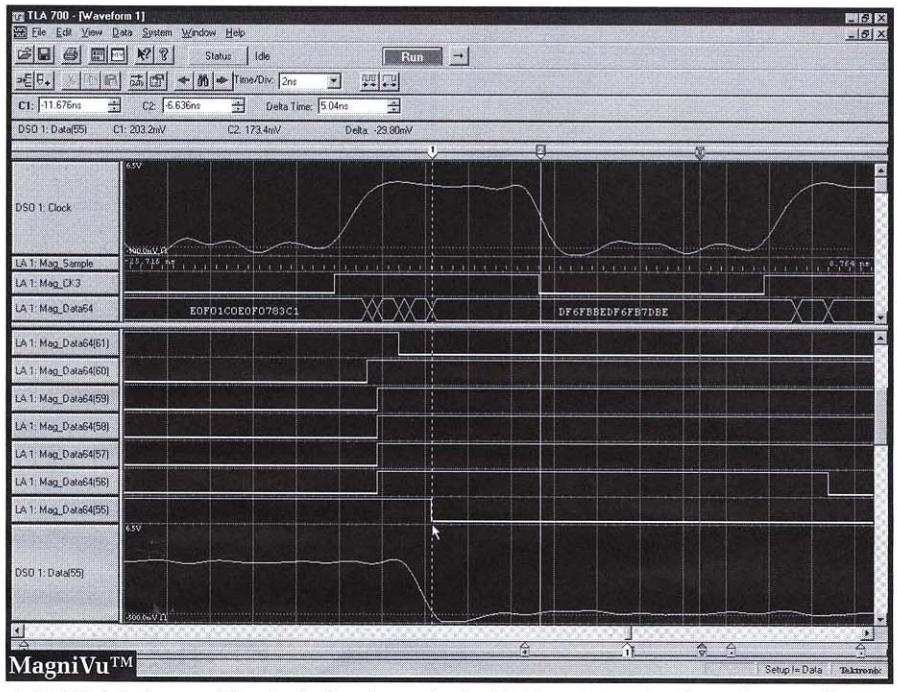
WORLD-CLASS DSO MODULES

The TLA 700 Series offers a range of DSO modules that provide the acquisition capabilities of the world's best DSOs, tightly integrated with the TLA 700 logic analyzers.

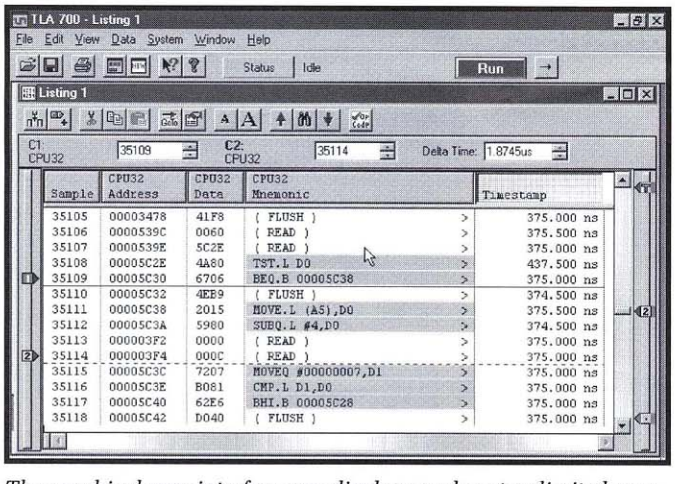
Tektronix wrote the book on oscilloscopes and Digital-Real-Time (DRT) technology, which brings the bandwidth of leading analog oscilloscopes to single-shot digital applications. The 2- and 4-channel DSO modules available in the TLA 700 Series offer sample rates of up to 5 GS/s and bandwidths of up to 1 GHz, with 15K record length, on all channels at all times.

The DSO modules offer precise time correlation and flexible cross-triggering with the other installed modules. This enables you to see the quality of critical signals alongside the digital behavior they affect.

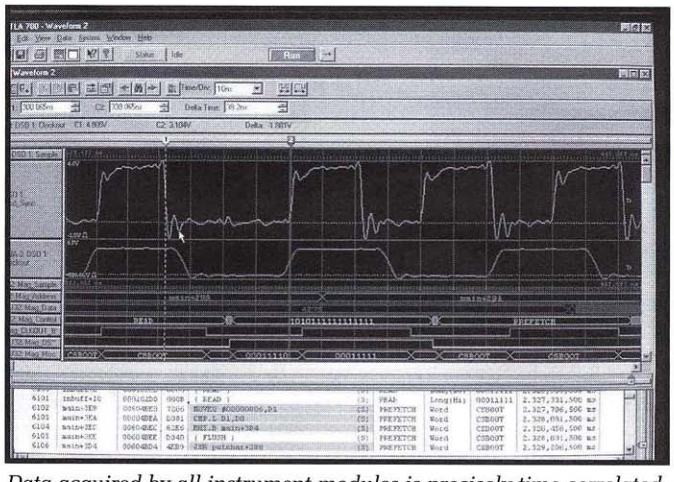
Logic and Time-domain Analog Fault Triggering. The DSO modules offer the kind of triggering you expect from a Tektronix DSO: Pulse Width, Runt, Glitch, Slew Rate, Logic Pattern, Setup-and-Hold Violation, Edge, and Timeout. All trigger modes can be fully time-qualified for any period from 2 ns to 1 s and are easily set up with a graphical user interface.



A 64-Bit data bus and its clock signal acquired with MagniVu technology, showing that the bus takes about 3 ns to settle when the value changes. Some individual data signals are shown also, including the first and last to change. The clock signal and the slowest data signal are shown as acquired by the DSO.

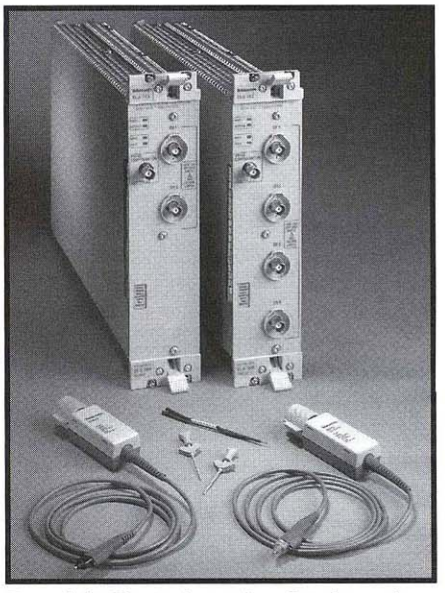


The graphical user interface can display an almost unlimited number of data windows. In a disassembly window, properties such as column width or text size and color can be easily changed by the user. Note the timestamp with 500 picosecond resolution.



Data acquired by all instrument modules is precisely time correlated. You can now easily see when signal quality causes timing faults.

Logic Analyzers
New TLA 700 Series

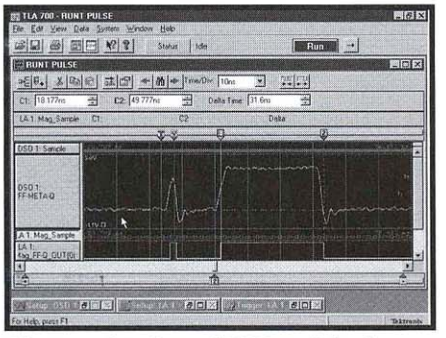


From left: The 2-channel and 4-channel DSO modules, shown with P6245 FET probes, are available with either 500 MHz or 1 GHz real-time bandwidth.

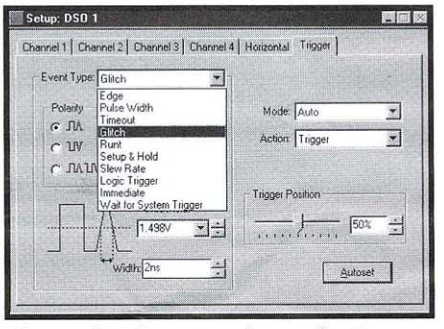
MAINFRAMES THAT ESTABLISH A PLATFORM FOR THE FUTURE

The TLA 700 Series mainframes offer a new paradigm for test instrumentation. Instead of building a proprietary compute engine into an instrument, Tektronix built in an industry-standard computer and operating system.

Both the portable TLA 704 and the benchtop TLA 711 have passed Microsoft's compatibility requirements for the "Designed for Microsoft Windows 95" logo. That means that you don't have to spend time learning how to navigate the user-interface because it works just like other PC-based software you've used. Because Windows 95 is fully integrated and embedded when you open the box, you get the benefit of a familiar environment without having to set things up yourself. This allows you to concentrate on the problem you're solving rather than the tool you're using.



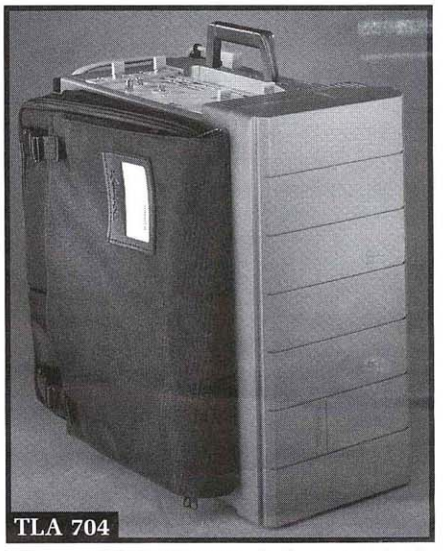
The 2- and 4-channel DSO modules have the performance to accurately capture signal quality and small glitches. A maximum of 20 1 GHz DSO channels is possible using the TLA 711 mainframe.



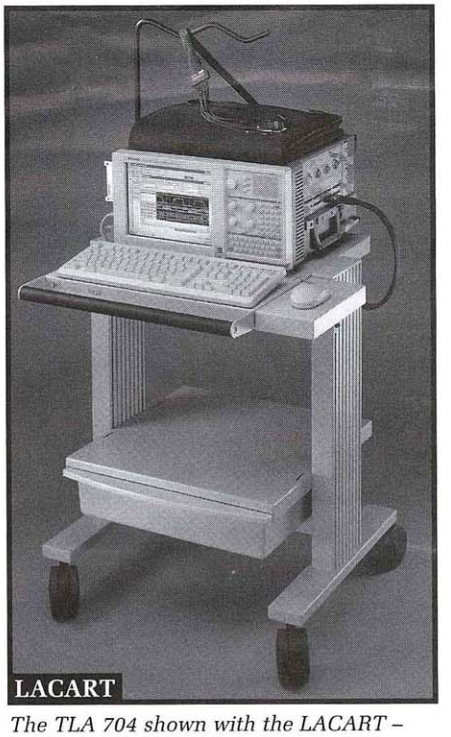
The graphical user interface makes it easy to select the trigger mode you need and quickly specify the precise characteristics of the anomaly you're looking for.

You also don't have to worry about how to integrate the TLA 700 into your test environment. Any accessories you can buy that connect a portable PC into your environment can be used directly on TLA 700 Series mainframes. Standard serial, parallel, SVGA, and PC Card, (PCMCIA) interfaces are used for external accessories.

All modules, software, and accessories are fully interchangeable between portable and benchtop mainframes.

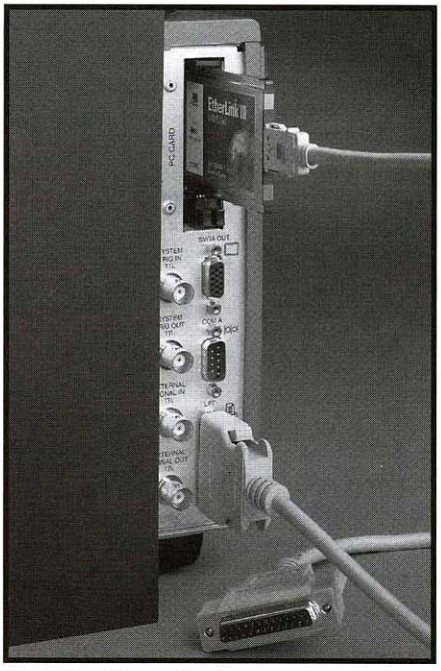


The portable TLA 704 includes a standard protective hard cover, accessory pouch, and integral carrying handle.

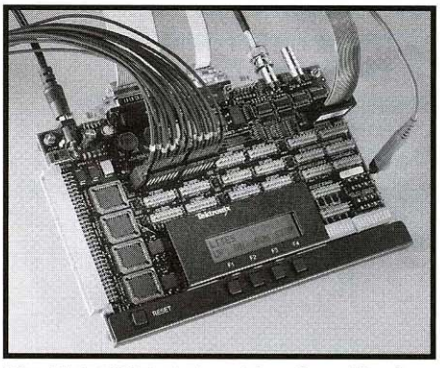


The TLA 704 shown with the LACART – also fully compatible with the TLA 711.

Logic Analyzers
New TLA 700 Series



The TLA 704 and TLA 711 include one Type II and one Type III PC Card (PCMCIA) slot and standard PC I/O – SVGA, parallel printer, and RS-232. Optional LAN card shown installed.



The TLA 7QS training aid and workbook will quickly help you become familiar with your new instrument.

Characteristics

GENERAL

Number of Channels per Module (all channels are acquired including clocks) –
TLA 7L1, TLA 7M1: 34 channels (2 are clock/qual channels).
TLA 7L2, TLA 7M2: 68 channels (4 are clock/qual channels).
TLA 7L3, TLA 7M3: 102 channels (6 are clock/qual channels).
TLA 7L4, TLA 7M4: 136 channels (8 are clock/qual channels).

Channel Grouping – No limit to number of groups or number of channels per group (all channels can be reused in multiple groups).

Module "Merging" – Two 102-CH or 136-CH modules can be "merged" to make a 204-, 238-, or 272-CH module. Merged modules exhibit the same depth as the lesser of the two individual modules. Word/range/setup-and-hold/glitch/transition recognizers span both modules. Only one set of clock connections is required.

Time Stamp – 50-Bits at 500 ps resolution (6.5 day range).

Clocking/acquisition Modes – State, timing, simultaneous.

Number of Mainframe Slots Required – 2.

INPUT CHARACTERISTICS (WITH P6417 OR P6434 PROBES)

Capacitive Loading – 2 pf typical.

Threshold Selection Range – From +5.0 V to –2.0 V in 50 mV increments.

Threshold Selection Channel Granularity – Separate selection for clock (1) and data (16) for each 17-CH probe connector.

Threshold Accuracy (including probe) – ±100 mV.

Input Voltage Range –
Operating: 8 V_{P-P} centered around the programmed threshold.
Non-destructive: ±15 V.

Input Signal Swing (probe overdrive) – ±250 mV or ±25% of signal swing, whichever is greater.

Input Signal Minimum Slew Rate – 200 mV/ns typical.

STATE ACQUISITION CHARACTERISTICS

Maximum Synchronous Clock Rate – 100 MHz standard, 200 MHz optional.

State Memory Depth – 32 K, 128 K, or 512 Kbits per channel.

Setup Time Selection Range – From 8.5 ns before to 7.0 ns after clock edge.

Setup-and-hold Window – 2.0 ns typical.

Minimum Clock Pulse Width – 2 ns.

Active Clock Edge Separation – 5 ns.

Demux Channel Selection – 32 channels can be demultiplexed to other channels by user.

TIMING ACQUISITION CHARACTERISTICS

Main Timing Resolution – 4 ns to 50 ms.

Main Timing Resolution with Glitch Storage Enabled – 10 ns to 50 ms.

Main Timing Memory Depth (with or without transitional storage enabled) – 32 K, 128 K, or 512 Kbits per channel.

Main Timing Memory Depth with Glitch Storage Enabled – Half of default main memory depth.

MagniVu™ Timing Resolution – 500 ps.

MagniVu Timing Memory Depth – 2 Kbits (2048) per channel.

Channel-to-channel Skew – ≤1 ns typical.

Minimum Recognizable Pulse Width (single channel) – 2 ns.

Minimum Recognizable Glitch Width (single channel) – 2 ns.

Minimum Recognizable Multi-channel Trigger Event – Sample period + 2 ns.

Logic Analyzers
New TLA 700 Series

TRIGGER CHARACTERISTICS

Independent Trigger States – 16.

Independent If/then Clauses per State – 4.

Maximum Number of Events per If/then Clause – 8.

Maximum Number of Actions per If/then Clause – 8.

Maximum Number of Trigger Events – 2 counters plus any 16 other resources.

Number of Word Recognizers – 16.

Number of Range Recognizers – 4.

Number of Counters – 2.

Trigger Event Types – Word, channel, transition, range, anything, counter value, signal, glitch, setup-and-hold violation.

Trigger Action Types – Trigger module, trigger all, store, don't store, start store, stop store, increment counter, reset counter, goto state, set/clear signal, do nothing.

Trigger Sequence Rate – DC to 250 MHz (4 ns).

Counter Range – 51-Bits each (>100 days @ 4 ns).

Counter Rate – DC to 250 MHz (4 ns).

Range Recognizers – Double bounded (can be as wide as any group, must be grouped according to specified order of significance).

Setup-and-hold Violation Recognizer Setup Time Range – From 8 ns before to 7 ns after clock edge in 0.5 ns increments.

Setup-and-hold Violation Recognizer Hold Time Range – From 7 ns before to 8 ns after clock edge in 0.5 ns increments.

Trigger Position – Any data sample.

MagniVu™ Trigger Position – MagniVu data is centered around the module trigger.

Storage Control (data qualification) – Global (conditional), by state (start/stop), by trigger action, or transitional.

Storage Window Granularity – Single sample or block-of-31 samples before and after.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	262	10.3
Width	61	2.4
Depth	381	15.0
Weight	**kg**	**lb.**
Net	3.1	6.7
Shipping	6.3	13.7

P6417 Probe Cable Length – 1.8 m (6 ft).

P6434 Probe Cable Length – 1.6 m (5 ft. 2 in.).

DSO Module Characteristics

GENERAL

Number of Channels per Module –
TLA 7D2, TLA 7E2: 4 channels.
TLA 7D1, TLA 7E1: 2 channels.

Sample Rate –
TLA 7E1, TLA 7E2: 5 GS/s on all channels.
TLA 7D1, TLA 7D2: 2.5 GS/s on all channels.

Bandwidth (at probe tips) –
TLA 7E1, TLA 7E2:
100 mV to 10 V range: 1 GHz.
50 mV to 99.8 mV range: 900 MHz.
20 mV to 49.8 mV range: 600 MHz.
All others: 500 MHz.
TLA 7D1, TLA 7D2: 500 MHz on all channels in all ranges.

Memory Depth – 15,000 samples per channel in all modes.

Number of Mainframe Slots Required – 2.

VERTICAL SYSTEM

Input Sensitivity Range – 10 mV to 100 V full scale.

Vertical Resolution – 8-Bits (256 levels).

DC Gain Accuracy – ±1.5% of full scale range.

Analog Bandwidth Selections – 20 MHz, 250 MHz, and Full.

Input Coupling – AC, DC, or GND.

Input Impedance Selections – 1 MΩ in parallel with 10 pf, or 50 Ω.

AC Coupled Lower Frequency Limit – ≤10 Hz when AC 1 MΩ coupled, ≤200 kHz when AC 50 Ω coupled.

Maximum Input Voltage at Probe Connector – 300 VRMS, but no greater than ±420 V peak (1 MΩ or ground input coupling).

Logic Analyzers
New TLA 700 Series

PROBE INPUT CHARACTERISTICS
Probe Input Interface – TEKPROBE® probe interface.

Input Loading – Less than 1 pf in parallel with 1 MΩ with either P6243 or P6245.

Usable Input Voltage Range at Probe Tip – P6243 Probe: ±8 V.
P6245 Probe: ±18 V.

ACQUISITION SYSTEM
Sample Rate Range – 200 ps to 200 ms in 1, 2.5, 5 sequence.

Timebase Accuracy – ±100 ppm over any interval ≥1ms.

Record Length Range – 512 to 15,000 samples per channel in all modes.

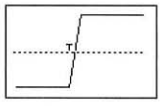
Acquisition Modes – Single-shot, repetitive.

TRIGGER SYSTEM
Trigger Modes – Normal, auto.

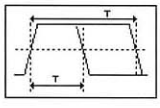
Trigger Position – Anywhere in the acquired record (pre-fill can be set anywhere from 0% to 100%).

Trigger Types – Edge, pulse width, timeout, glitch, runt, slew rate, logic pattern, setup-and-hold violation.

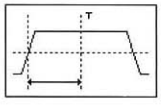
Trigger Actions – Trigger, trigger all, set signal, arm, immediate, wait for system trigger.



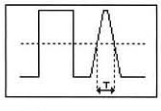
Edge Trigger – Conventional level driven trigger, positive or negative slope, on any channel or external trigger input. Coupling Selections: DC, AC, noise reject, HF reject, LF reject.



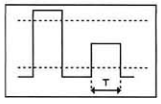
Pulse Width Trigger – Trigger on width of positive or negative pulse, either within or not within selectable time limits; settable from 2 ns to 1 s.



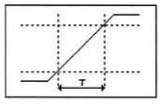
Timeout Trigger – Triggers when a pulse fails to complete when specified; settable from 2 ns to 1 s.



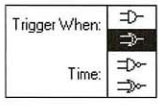
Glitch Trigger – Trigger on (or reject) glitches of positive, negative, or either polarity; settable from 2 ns to 1 s. Minimum glitch width: 2.0 ns, with 200 ps resolution (2 ns to 10 ns settings).



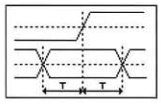
Runt Pulse Trigger – Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again; settable from 2 ns to 1 s.



Slew Rate Trigger – Trigger on pulse edge rates that are either faster or slower than a set rate, edges can be rising, falling, or either; settable from 2 ns to 1 s.



Logic Pattern Trigger – Triggers when a logical combination (AND, OR) of all the input channels (Hi, Lo, Don't Care) stays true or false for a specified period of time; settable from 2 ns to 1 s.



Setup-and-hold Trigger – Trigger on violations of both setup time and hold time between clock and data which are on separate input channels; setup time settable from –100 ns to +100 ns in 200 ps increments; hold time settable from –1 ns to +102 ns; minimum settable window of setup time + hold time is 2 ns.

Logic Analyzers
New TLA 700 Series

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	262	10.3
Width	61	2.4
Depth	381	15.0
Weight	**kg**	**lb.**
Net	2.7	5.8
Shipping	5.8	12.8

P6243 Probe Cable Length – 1.3 m (51 in.).

P6245 Probe Cable Length – 1.3 m (51 in.).

Other Compatible Probes – P6139A, P6204, P5100, P6205, P6408, P6563A, P6701B, P6703B, AM 503S.

Mainframe Characteristics

PC CHARACTERISTICS (TLA 704 AND TLA 711)

Compatibility – Passed Microsoft's compatibility requirements for the "Designed for Microsoft Windows 95" logo.

Processor – 133 MHz Pentium.

DRAM – 16 MB EDO (32 MB with Opt. 1S).

Second-Level Cache – 256 KB pipeline burst cache with writeback.

Display Memory – 1 MB.

Sound – Built in PC speaker transducer; multimedia sound can be added via PC Card interface.

Hard Disk Drive – 840 MB (2.16 GB with opt. 1S).

Floppy Disk Drive – Built-in 3.5 in. 1.44 MB drive.

INTEGRAL CONTROLS (TLA 704 ONLY)

Front-Panel Display –
Size: 10.4 in. diagonal.
Type: Active-matrix color TFT LCD with backlight.
Resolution: 640 x 480.
Colors: 256.

Simultaneous Display Capability – Both the front-panel and external displays can be used simultaneously at 680 x 480 resolution.

Front-panel Knobs – Special function knobs for instrument control.

Front-panel Qwerty Keypad – Mini-QWERTY keypad and Hex keypad.

Front-panel Pointing Device – Glidepoint finger pad.

EXTERNAL PERIPHERAL INTERFACES (TLA 704 AND TLA 711)

External Display Port Type – 15-Pin sub-D SVGA connector.

External Display Resolution – Up to 1024 x 768, 256 colors.

External Display Compatibility – DDC1 (Dynamic Display Configuration 1).

External Keyboard Port Type – PS mini-DIN.

External Mouse Port Type – PS2 mini-DIN.

Parallel Interface Port Type – IEEE 1284-C connector (comes with three-foot adapter cable to female DB25 connector).

Parallel Interface Modes – Centronics mode, EPP (Extended Parallel Port), ECP (Microsoft high-speed mode).

Serial Interface Port Type – Male DB9.

PC Card (PCMCIA) Slot Types – Two slots, one PC Card Type I/II and one PC Card Type I/II/III.

EXTERNAL INSTRUMENTATION INTERFACES (TLA 704 AND TLA 711)

System Trigger Output – Asserted whenever a system trigger occurs (TTL-compatible output, back-terminated into 50 Ω).

System Trigger Input – Forces a system trigger (triggers all modules) when asserted (TTL-compatible, edge-sensitive, falling-edge latched).

External Signal Output – Can be used to drive external circuitry from a module's trigger mechanism (TTL-compatible output, back-terminated into 50 Ω).

External Signal Input – Can be used to provide an external signal to arm or trigger any or all modules (TTL-compatible, level-sensitive).

Instrument Slots –
TLA 704: Holds 4 single-wide or 2 double-wide modules.
TLA 711: Holds 11 single-wide or 5 double-wide modules.

Logic Analyzers
New TLA 700 Series

POWER

TLA 704 –
Voltage range/frequency: 90-250 VACRMS @ 45-66 Hz and 100-132 VACRMS @ 360-440 Hz.
Input current: 6 A maximum at 90 VAC (70 A surge).
Power consumption: 600 W maximum.

TLA 711–
Input voltage: 90-250 VACRMS @ 45-66 Hz, 100-132 VACRMS @ 360-440 Hz.
Input current: 15 A maximum at 90 VAC (70 A surge).
Power consumption: 1350 W maximum.

PHYSICAL CHARACTERISTICS

TLA 704 – PORTABLE

Dimensions	mm	in.
Height	216	8.5
Width	419	16.5
Depth	432	17.0
Weight	**kg**	**lb.**
Net (w/o modules)	11.4	25
Shipping (typical)	25.5	56

TLA 711 – BENCHTOP

Dimensions	mm	in.
Height	356	14.0
Width	424	16.7
Depth	673	26.5
Weight	**kg**	**lb.**
Net (w/o modules)	22.7	50
Shipping (typical)	51.8	114

Parallel Interface Adapter Cable Length – 91 cm (3 ft.).

P6041 External Signal Cable Length – 1.1 m (42 in.).

ENVIRONMENTAL

Temperature –
Operating: –15° C to +50° C.
Non-operating: –20° C to +60° C.

Humidity –
Operating: ≤30° C: 95% relative humidity.
31° C to +50° C: 45% relative humidity.
Non-operating: ≤50° C: 95% non-condensing.

Altitude –
Operating: –1,000 ft to 10,000 ft.
Non-operating: –1,000 ft to 40,000 ft.

CERTIFICATION MARKINGS
UL; cUL; CE; C-TICK.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TLA 704
Portable Color Mainframe
Includes: Mouse, Keyboard, Front-panel Cover, Accessory Pouch, Panel Fillers for Empty Slots, Printer Adapter Cable, North American 120 V Power Cord, Software, Manuals, Certificate of Traceable Calibration, and One-year Warranty (return to Tektronix).

TLA 711
Benchtop Color Mainframe
Includes: Mouse, Keyboard, Panel Fillers for Empty Slots, Printer Adapter Cable, P6041 External Signal Cables (2); North American 120 V Power Cord, Software, Manuals, Certificate of Traceable Calibration, and One-year Warranty (return to Tektronix). Display is not included – order Opt. 1M or Opt. 2M or use any SVGA monitor.

OPTIONS – TLA 704/711

Opt. 1S – 32 MB DRAM/2.16 GB HDD upgrade.

Opt. 1A – Add LAN PC Card (119-5510-00).

Opt. 1M – Add 17-in. monitor (119-5430-00).

Opt. 2M – Add 21-in. monitor (119-5422-00).

Opt. 1K – Add LACART logic analyzer cart.

INTERNATIONAL POWER CORD OPTIONS

Opt. A1 – Universal Euro 220 V; 50 Hz.

Opt. A2 – UK 240 V; 50 Hz.

Opt. A3 – Australian 240 V; 50 Hz.

Opt. A4 – North American 240 V; 60 Hz.

Opt. A5 – Switzerland 220 V; 50 Hz.

TLA 704 /TLA 711 SERVICE OPTIONS

Opt. 95 – Add calibration test data report.

Opt. IN – Product installation service (on-site configuration and user familiarization; excluding network integration).

Opt. C3 – Three years of calibration service (includes initial calibration and two annual calibrations).

Opt. D3 – Provides test data for each calibration (must be ordered with Opt. C3).

Opt. R3 – Extends depot repair warranty service period to three years.

Opt. S1 – Uplifts standard one-year warranty service of mainframe and installed modules to on-site service.

Opt. S3 – Uplifts Opt. C3 and/or R3 of mainframe and installed modules to on-site service (must be ordered with Opt. C3 and/or R3).

TLA 704 / TLA 711 ACCESSORIES

Logic Analyzer Cart – LACART.

TLA 711 Rackmount Kit – Order 020-2197-00.

TLA 704 Wheeled Transport Case – Order 016-1522-00.

TLA704/711 Portable QWERTY Keyboard – Order 118-9402-00.

TLA 7QS – TLA 700 Series Training Package (includes North American 120 V power adapter) Opt. A1: Universal Euro 220 V, 50 Hz Power Adapter.
Opt. A2 – UK 240 V, 50 Hz Power Adapter.
Opt. A6 – Japan 100 V, 60 Hz Power Adapter.

TLA 700 SERIES SERVICE DOCUMENTS AND TEST FIXTURES

TLA 704 Service Manual – Order 070-9777-00.

TLA 711 Chassis Service Manual – Order 070-9773-00.

TLA 711 Controller Service Manual – Order 070-9778-00.

TLA 700 Series Performance Verification and Adjustment Technical Reference Manual – Requires Logic Analyzer Module Adjustment Fixture Order 070-9776-00.

TLA 7Lx/7Mx Logic Analyzer Module Adjustment Fixture (includes AC adapter; requires local power cord) – Order 671-3599-00.

TLA 7Lx/7Mx Logic Analyzer Modules Service Manual – Order 070-9779-00.

TLA 7Dx/7Ex DSO Modules Service Manual – Order 070-9780-00.

TLA 7QS QuickStart™ Training Module Service Manual – Order 070-9716-00.

TLA 704/TLA 711 MAINFRAME FIELD UPGRADES

TLA 7F1 Max DRAM/Hard Disk Upgrade Kit – Substitutes 32 MB DRAM and 2.16 GB Hard Disk Drive.

TLA 7F3 Software Upgrade Kit – Upgrade all mainframe software including Microsoft Windows 95; TLA 700 Series application and diagnostics.

LOGIC ANALYZER MODULES

Includes: P6417 Probes (each includes two 8-CH leadsets, one 1-CH leadset, and 20 SMT KlipChip™ Grabber tips), Manual, Certificate of Traceable Calibration, and One-year Warranty (return to Tektronix).

TLA 7L1 – 34-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 32 K depth (two P6417 Probes).

TLA 7L2 – 68-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 32 K depth (four P6417 Probes).

TLA 7L3 – 102-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 32 K depth (six P6417 Probes).

TLA 7L4 – 136-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 32 K depth (eight P6417 Probes).

TLA 7M1 – 34-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 512 K depth (two P6417 Probes).

Logic Analyzers
New TLA 700 Series

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TLA 7M2 – 68-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 512 K depth (four P6417 Probes).

TLA 7M3 – 102-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 512 K depth (six P6417 Probes).

TLA 7M4 – 136-CH Logic Analyzer module, 2 GHz timing, 100 MHz state, 512 K depth (eight P6417 Probes).

LOGIC ANALYZER MODULE OPTIONS

Opt. 1S – Substitute 200 MHz state capability.

Opt. 2S – Substitute 128 Kbits per channel for 32 K depth.

LOGIC ANALYZER MODULE SERVICE OPTIONS

Opt. 95 – Add calibration test data report.

Opt. IN – Product installation service (on-site configuration and user familiarization, excluding network integration).

Opt. C3 – Three years of calibration service (includes initial certification and two annual calibrations).

Opt. D3 – Provide test data for each calibration (must be ordered with Opt. C3).

Opt. R3 – Extends depot repair warranty service period to three years.

LOGIC ANALYZER MODULE ACCESSORIES

P6417 – 17-CH Probe and Accessories for TLA 7Lx/TLA 7Mx.

17-CH Probe Accessory Kit – Order 020-2198-00.

Probe Repair Kit for P6417 – Order 020-2196-00.

Podlet Repair Kit for P6417 – Order 020-2200-00.

34-CH Probe Interface Kit w/ Barrel Connectors – Order 020-2199-00.

34-CH Probe Interface Kit w/Mini-PV Connectors – Order 020-3000-00.

P6434 – 34-CH High-density Probe for TLA 7Lx/TLA 7Mx.

P6434 Mass Termination Probe Instruction Manual – Includes information for designing P6434 connectors into your circuit boards. Order 070-0793-00.

192-CH High-density Probe for TLA 7Lx/TLA 7Mx – Order LAHDP2.

Opt. 01 – Add 2 cables.

Opt. 02 – Add 2 connectors.

NOTE: Microprocessor probe adapters and disassembly software is available for popular devices. Ask your Tektronix account manager for details.

TLA 7F2 POWERFLEX™ UPGRADE KITS

For upgrading logic analyzer modules after initial purchase. Installation must be performed by Tektronix personnel (installation charges vary by location).

TLA 7F2 (must be ordered with appropriate option(s).

Opt. 1M – Increase TLA 7L1 memory depth from 32 K to 128 Kbits/channel (maximum depth available in TLA 7L1).

Opt. 2M – Increase TLA 7L2 memory depth from 32 K to 128 Kbits/channel (maximum depth available in TLA 7L2).

Opt. 3M – Increase TLA 7L3 memory depth from 32 K to 128 Kbits/channel (maximum depth available in TLA 7L3).

Opt. 4M – Increase TLA 7L4 memory depth from 32 K to 128 Kbits/channel (maximum depth available in TLA 7L4).

Opt. 1S – Increase TLA 7L1 state speed from 100 MHz to 200 MHz.

Opt. 2S – Increase TLA 7L2 state speed from 100 MHz to 200 MHz.

Opt. 3S – Increase TLA 7L3 state speed from 100 MHz to 200 MHz.

Opt. 4S – Increase TLA 7L4 state speed from 100 MHz to 200 MHz.

Opt. 5S – Increase TLA 7M1 state speed from 100 MHz to 200 MHz.

Opt. 6S – Increase TLA 7M2 state speed from 100 MHz to 200 MHz.

Opt. 7S – Increase TLA 7M3 state speed from 100 MHz to 200 MHz.

Opt. 8S – Increase TLA 7M4 state speed from 100 MHz to 200 MHz.

DSO MODULES

Includes: Probes, Manual, Certificate of Traceable Calibration, and One-year Warranty (return to Tektronix).

TLA 7D1 – 2-CH DSO module, 500 MHz bandwidth, 2.5 GS/s sample rate, 15 K depth (includes two P6243 1.0 GHz active FET probes, probe calibration adapter, and manual).

TLA 7D2 – 4-CH DSO module, 500 MHz bandwidth, 2.5 GS/s sample rate, 15 K depth (includes four P6243 1.0 GHz active FET probes, probe calibration adapter, and manual).

TLA 7E1 – 2-CH DSO module, 1 GHz bandwidth, 5 GS/s sample rate, 15 K depth (includes two P6245 1.5 GHz active FET probes, probe calibration adapter, and manual).

TLA 7E2 – 4-channel DSO module, 1 GHz bandwidth, 5 GS/s sample rate, 15 K depth (includes four P6245 1.5 GHz active FET probes, probe calibration adapter, and manual).

DSO MODULE SERVICE OPTIONS

Opt. 95 – Add calibration test data report.

Opt. IN – Product installation service (on-site configuration and user familiarization, excluding network integration).

Opt. C3 – Three years of calibration service (includes initial certification and two annual calibrations).

Opt. D3 – Provide test data for each calibration (must be ordered with Opt. C3).

Opt. R3 – Extends depot repair warranty service period to three years.

DSO MODULE ACCESSORIES

PROBES (See page 438).

P6243 FET Probe – 1.0 GHz Active FET probe and accessories, length 1.5 m.

P6245 FET Probe – 1.5 GHz Active FET probe and accessories, length 1.5 m.

P6246 – 400 MHz, 30 dB CMRR differential probe.

P6247 – 1.0 GHz 30 dB CMRr differential probe.

TCP202 – Current probe, DC-15A, DC-50 MHz

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

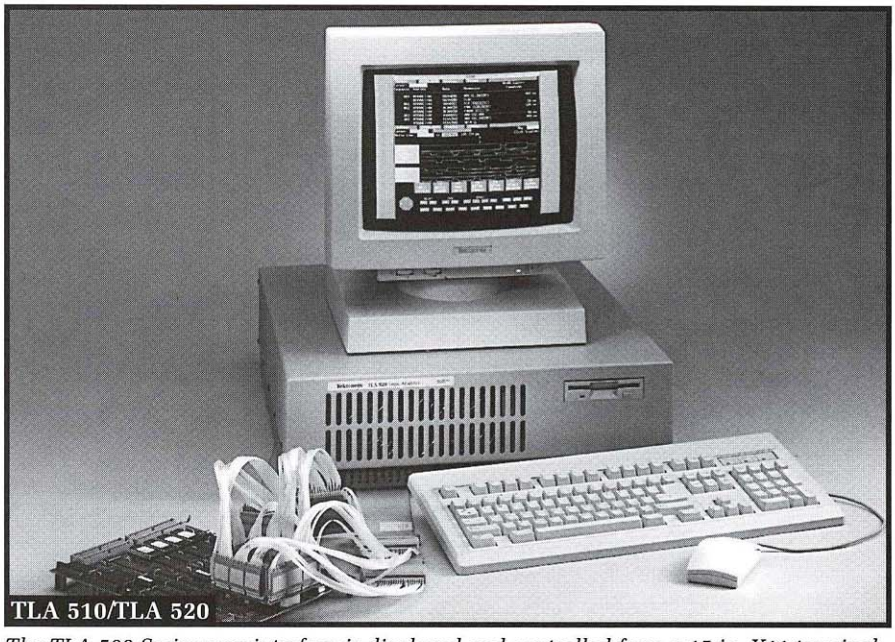
TLA 500 Logic Analyzers

TLA 510 • TLA 520

Features

TLA 510/TLA 520

- 100 MHz State Analysis
- 400 Ms Timing Analysis
- 8 K to 8 M Acquisition Memory Depths
- 100, 150 and 200 Channel Widths Models
- High Performance RISC/CISC Microprocessor Support
- Advanced Performance Analysis
- Links to High Level Languages for Software Debug
- Compliant with CISPR IIA Radiated and Conducted Emissions Requirements
- 18-CH, 50 MHz Algorithmic Pattern Generator



The TLA 500 Series user interface is displayed and controlled from a 15 in. X11 terminal. A 17 in. terminal is optionally available.

Excellent Price/Performance

The TLA 500 Series has the performance necessary to solve the tough software/hardware integration and software debug problems previously available only in high-performance analysis systems.

SIZED TO THE TASK

The TLA 510 includes 100 channels (96 data and four clock) of 100 MHz acquisition. This is ideal for most single processor applications. The TLA 520 includes 200 channels of 100 MHz acquisition that can be divided to support two processors time correlated, or combined to support one advanced processor. The TLA 520 can optionally be configured as one 100 channel and one 50 channel acquisition. This is convenient when the integration task requires single processor support with separate, but time correlated, state or timing channels.

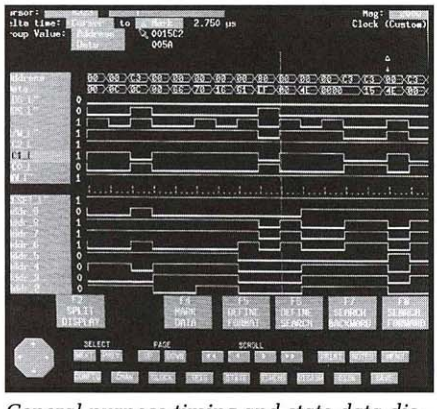
ROBUST COMMUNICATION CAPABILITY

LAN Ethernet and RS-232 communication comes standard with each TLA 500. Optional and accessory application software offers full remote control capability across the LAN network.

POWER*FLEX*™, THE FIRST SCALABLE ARCHITECTURE

The Power*Flex* technology allows the TLA 500 to grow in memory depth and channels without throwing away major portions of your investment. The capability of the instrument can quickly and economically grow as the debug complexity of the target system increases.

All TLA 500 acquisition modules come standard with 8 K of memory. Synchronous acquisition memory depths of 32 K, 128 K, 512K and 2 M are optionally available. Both channel count and memory depth can be easily upgraded in the future using the Power*Flex* capability.



General purpose timing and state data displays are available either as independent displays, or time correlated with the microprocessor acquisition.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

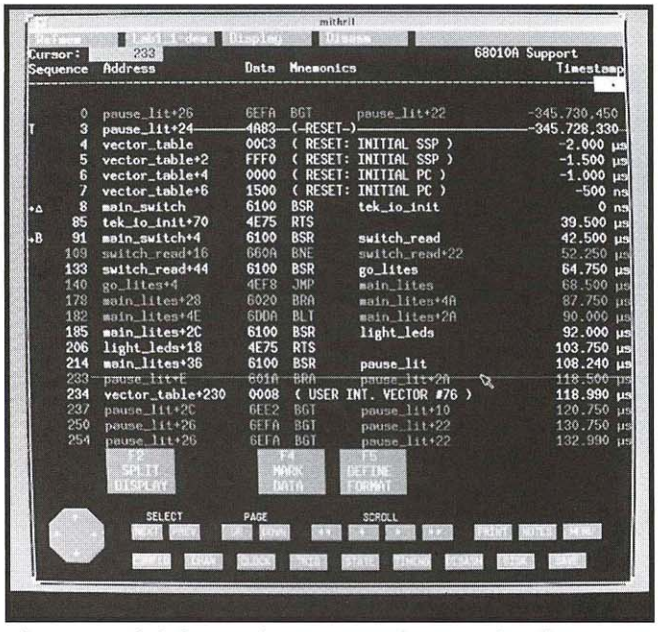
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

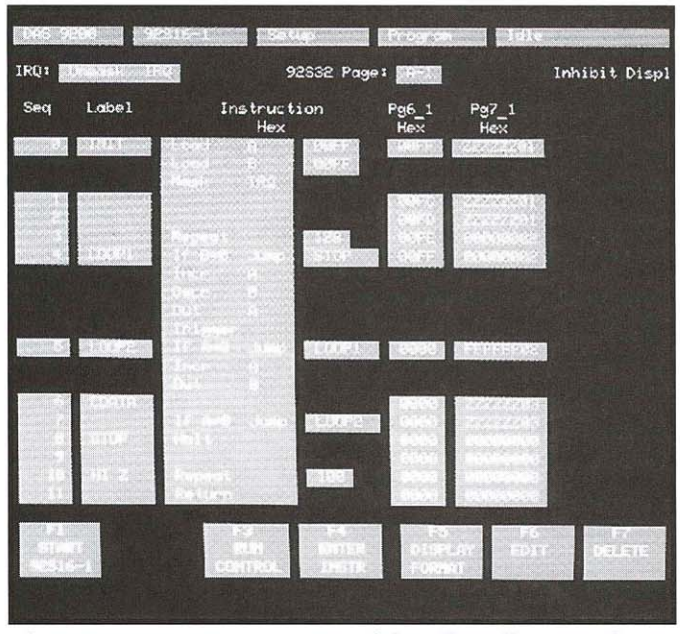
Tektronix Measurement products are manufactured in ISO registered facilities.

TLA 500 Logic Analyzers

TLA 510 • TLA 520



The point-and-click X-windows user interface provides efficient setup and rapid display selections. Various modes of displays can be displayed simultaneously, e.g., Disassembly and Timing.



The 50 MHz pattern generation capability offers efficient, real-time hardware simulation, external event simulation or fault injection.

MULTIPLE DATA DISPLAYS

Beyond the basic state and timing data displays there are four levels of disassembly display available with high level language symbols for software debug.

The Graph display plots acquired data value versus sequence. This is useful to spot errant software execution and for A/D display applications.

ADVANCED PRINT SUPPORT

Both screen images and data files are efficiently printed. Postscript, LaserJet, PCX and BMP are all supported formats. The images can be output to either a local printer or a printer on the LAN network. Alternatively the images are stored in either a local file or transferred across the network to a remote file.

PATTERN GENERATION FOR SIMULATION AND FAULT INJECTION

The TLA 510 offers optional 50 MHz algorithmic pattern generation support TTL signals with Tristate. The 18 channels of TTL signals, with Tristate, can be programmed with specific data values or driven from internal registers that can be loaded, incremented and decremented. Robust branching and looping capability allows full programming of up to 1,000 sequences.

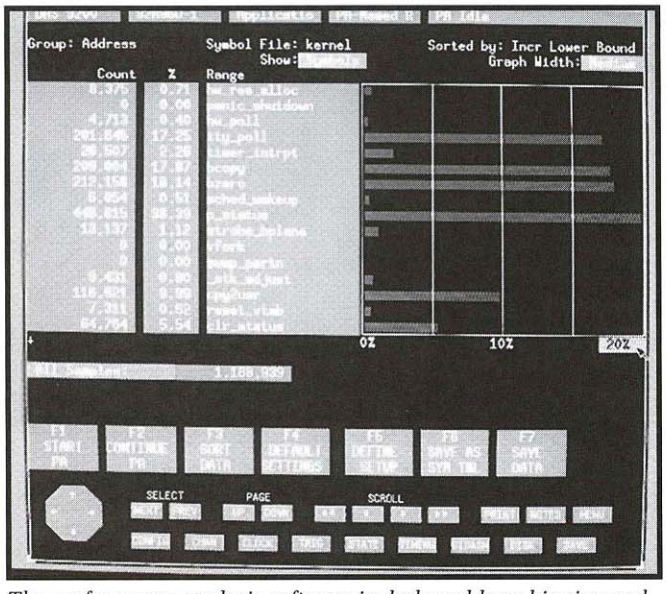
Optional accessory probes are available to control the program sequencing from external events and/or add fully programmable pulse timing capability. ECL probe capability is also available.

The pattern generator can be used to simulate hardware that is not available or real-time events on an external bus. It can also inject real-time faults into a target for system analysis.

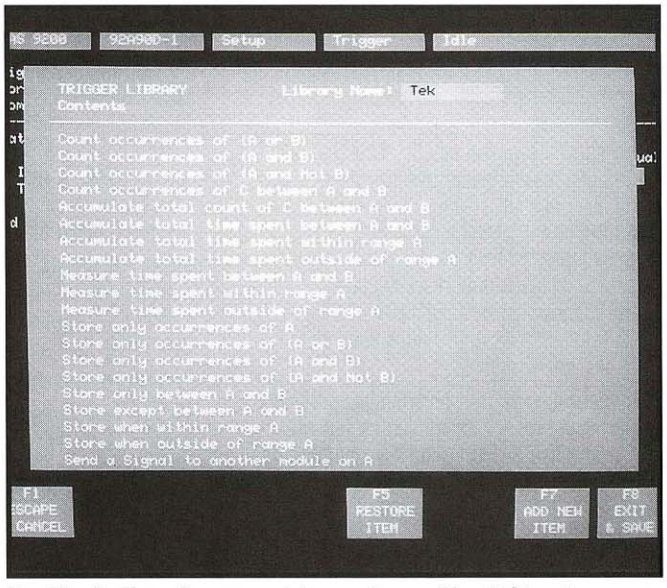
The TLA 510 is compatible with our other pattern generator cards (page 131).

TLA 500 Logic Analyzers

TLA 510 • TLA 520



The performance analysis software includes address binning and event timing modes to quickly determine where performance improvements are needed. Support for 5000 ranges, symbolic representation and data output coupled with deep memory make this a powerful analysis tool.



Rapid selection of common trigger setups, either Tektronix or user defined, access the power of the state-based trigger machine without requiring detailed programming.

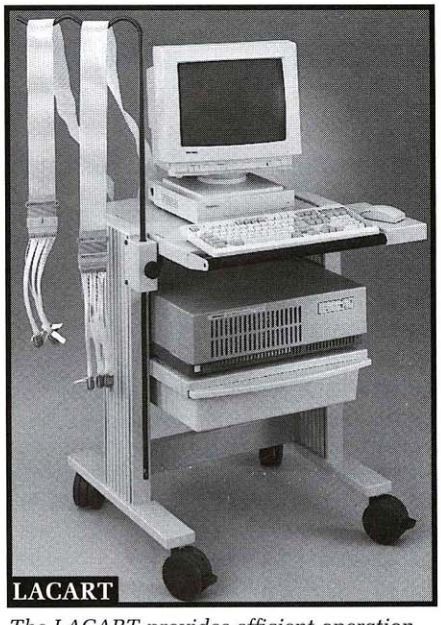
SYMBOLIC PERFORMANCE ANALYSIS

It has become vitally important to know how well your embedded system is performing. The optional performance analysis software charts a histogram of the percentage of execution time spent in each range of software. The screen updates rapidly and the ranges can be sorted while running. The display quickly shows where the bulk of the execution time is being spent. An alternate analysis mode displays a histogram of the range of time required for a particular event, e.g., interrupt latency.

Data can be sorted into 5,000 ranges allowing concise range placement. Data for the ranges can be imported directly from your computer, easing the definition of ranges. The output can be saved as an ASCII file for further analysis.

SIMPLIFIED TRIGGER SETUP

A robust set of pre-programmed triggers addresses the common types of desired trigger definitions. Just select the trigger type and enter the specific data, e.g., address value. Users can also define libraries of trigger definitions commonly used in their environment.



The LACART provides efficient operation of your logic analyzer and quick movement between lab stations.

TLA 500 Logic Analyzers

TLA 510 • TLA 520

ENTERPRISE INSTRUMENTATION CAPABILITIES

It is becoming increasingly important to connect the logic analyzer into the engineering network to maximize the efficiency of the debug and integration cycle. The TLA 500 series offers two levels of enterprise capability. An optional 17-inch X terminal display can replace the standard 15-inch model. The larger display provides a larger TLA 500 user interface or additional display room for other X applications across the network. The standard Telnet software provides remote log in to other workstations.

The second level of enterprise integration replaces the local X terminal display with a full interactive X display on the user's workstation. The TLA 500 can be accessed, single user, from any X11 compatible workstation on the network.

LONG TERM PRODUCT SUPPORT

Every TLA 500 is delivered to you with a full one year on-site service coverage. (This support may not be available in all geographic areas. Check with your local Tektronix sales engineer.) Measurement Service Options may be purchased to extend coverage to three or five years at the time you purchase your system.

ROBUST APPLICATION SUPPORT

The TLA 500 is compatible with a wide range of advanced application software. (See pages 139-141.)

ADVANCED INSTRUMENTATION

The TLA 510 can be expanded by adding a module from the wide selection of DAS Centurion Acquisition modules and pattern generation modules.

The TLA 500 user interface can optionally be displayed and controlled from any X11 Windows compatible workstation or terminal.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TLA 510
100-CH, 8 K Memory, 100 MHz Acquisition.
Includes: LAN Ethernet and RS-232 Standard, 1.2 GB Hard Disk, 1.4 MB 3.5 in. Floppy Drive.

Opt. 01 – 32 K Memory.
Opt. 02 – 128 K Memory.
Opt. 03 – 512 K Memory.
Opt. 06 – 2M Memory.
Opt. 04 – Performance Analysis Software.
Opt. 30 – 18-CH, 50 MHz Pattern Generator.
Opt. 1P – Add Additional Probe Accessories.
Opt. 1X – Sub. 92XTERM Networked System Software.
Opt. 8S – Sub. ECL Coax Cable.
Opt. IN – On-site Installation.
Opt. 4X – Sub. 17" X terminal.
Opt. 5C – Thicknet LAN connector.

TLA 520
200-CH, 8 K Memory, 100 MHz Acquisition.
Includes: LAN Ethernet and RS-232 Standard, 1.2 GB Hard Disk, 1.4 MB 3.5 in. Floppy Drive.

Opt. 01 – 32 K Memory.
Opt. 02 – 128 K Memory.
Opt. 03 – 512 K Memory.
Opt. 06 – 2M Memory.
Opt. 04 – Performance Analysis Software.
Opt. 1D – Delete 50-CH of Acquisition.
Opt. IN – On-site installation.
Opt. 1P – Add Additional Probe Accessories.
Opt. 1X – Sub. 92XTERM Networked System Software.
Opt. 8S – Sub. ECL Coax Cable.
Opt. 4X – Sub. 17" X terminal.
Opt. 5C – Thicknet LAN connector.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
Opt. S3 – Three year upgrade to "On-site" Service.
Opt. S5 – Five year upgrade to "On-site" Service.
Opt. IN – Product Installation Service.
See page 581 for further information.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.
See Customer Information Section for additional description.

ADDITIONAL ACCESSORIES
Logic Analyzer Cart – Order LA Cart.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Analysis System

DAS® NT • DAS® XP

Features

DAS NT
DAS XP

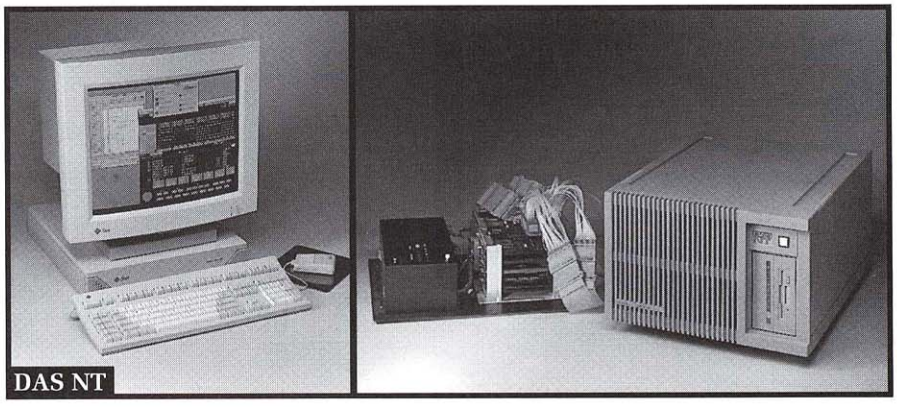
- 100 MHz State Analysis
- 400 Ms, Timing Analysis
- Up to 1536 Channels with 10 ns Resolution
- More than 500 Channels of 50/100 MHz Pattern Generation
- Acquisition Memory Depth from 8 K to 8 M
- Support for Most Popular RISC and CISC Microprocessors
- Multiprocessor Support for up to 10 CPUs at Once
- UL Listed 1244
- Certified to CSA C22.2 No. 231-M89

DAS NT

- Operates on Any XII/R4 Window Server
- Optional 15 in. and 17 in. Local X Terminal

DAS XP

- 15 in. X Terminal Standard
- Optional 17 in. X Terminal


DAS NT

The System Challenge

The design and debug of new multiprocessor systems with faster clocks, wider buses, and larger memories is a difficult task to undertake. Complete solutions to these problems are hard to find, and integrating the pieces of a solution are almost impossible.

The DAS NT Digital Analysis System is a complete answer to the needs of design, debug, and test. The advanced architecture of the DAS NT allows you to install all the data acquisition and pattern generation modules you need today without limiting your future demands. You can easily expand or reconfigure as your requirements change.

CONFIGURABLE INSTRUMENT FOR A BROAD RANGE OF APPLICATIONS

Multiple data acquisition and pattern generation cards can be added to a DAS NT system. The cards you select can be grouped into subsystems, allowing you to create virtual instruments within the DAS system. These separate instruments can be controlled independently to observe multiple circuits at once. You can also increase channel widths by grouping like cards into a larger virtual card.

Cards can also interact in real time. For example, two acquisition modules running at different clock speeds can display the acquired data in a time-correlated format, simplifying the debug of multiprocessor designs. Or an acquisition module could wait for a specific event and then start a pattern generator.

THE EFFICIENCY AND PERFORMANCE OF ANALYSIS ON THE WORKSTATION

Many of the tools and most of the data used by designers today are resident on their personal workstations. The DAS NT brings the power of the DAS system to that same interface. All the power of the DAS system is available on an interactive X-window on the workstation. Data from the DAS system can be viewed simultaneously with data from other tools presented in other windows on the workstation. The X-window display is fully compatible with X11/R4 and higher servers.

COMPLEX DESIGNS REQUIRE PROBING OF MANY SIGNALS

As digital designs become more complex, more signals in the SUT (System Under Test) need to be observed to ensure proper operation. To probe those signals, an adequate number of acquisition channels must be available. Having almost enough channels means limiting data acquired, re-probing, or re-acquiring data.

Viewing the whole problem in context is the reason for a digital analysis system. But along with channel count, you require greater measurement performance and the ability to display the data in an intelligible format. The DAS NT display is designed to display large amounts of acquired data with powerful search, format, and symbol capabilities.

Since most logic analyzers can't handle hundreds of timing channels, they don't worry about displaying more than a few channels at a time. With the DAS NT bus waveform display, multiple 32-Bit buses can easily fit on the same timing diagram. Even the buses are cross-correlated to other displays.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

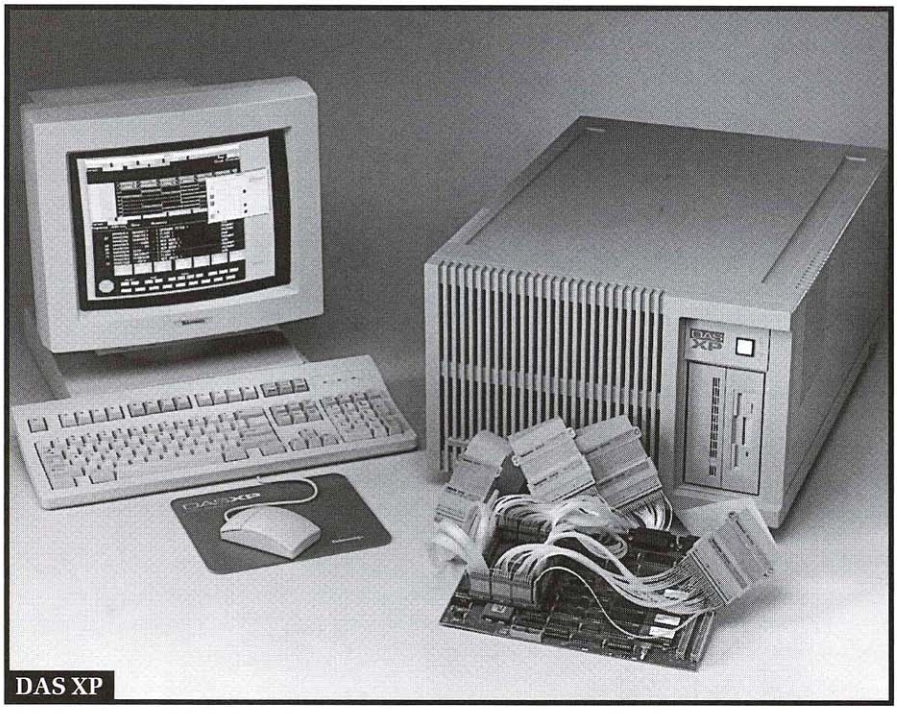
See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Analysis System
DAS® NT • DAS® XP


DAS XP

ADVANCED PRINT SUPPORT
Both screen images and data files are efficiently output. Postscript, LaserJet, PCX and BMP are all supported formats. The images can be output to either a local printer or a printer on the LAN network. Alternatively the images are stored in either a local file or transferred across the network to a remote file.

SIMPLIFIED TRIGGER SETUP
A robust set of pre-programmed triggers address the common types of desired trigger definitions. Just select the trigger type and enter the specific data, e.g., address value. Users can also define libraries of trigger definitions commonly used in their environment.

THE DAS XP - A MODERN USER INTERFACE FOR THE STANDALONE USER
The DAS system offers powerful analysis capability into applications that do not require the workstation environment. The DAS XP set of configured systems includes a Tektronix X terminal that provides the same powerful user interface as the DAS NT without requiring a network interface. All DAS system control and display functions are present with the DAS XP.

HIGH-PERFORMANCE MAINFRAMES THAT OFFER CHOICES
The high-performance DAS systems are controlled by a 40 MHz, 32-Bit CPU and contain 16 MB of system RAM, a 1.2 GB Hard Disk, a PC compatible 1.4 MB Floppy Drive and seven instrument slots. A removable hard disk is also available. The communications ports on the DAS systems include Ethernet LAN capability, three RS-232 I/O ports and an optional GPIB interface.

The DAS systems can also be controlled in a lab environment by using PCL, a complete, high level remote control language. PCL can be used to remotely control a DAS from another computer or controller, over Ethernet LAN, GPIB or RS-232.

Acquired data is easily documented for future reference. Full color printouts of any screen are available on the workstation by using SNAPSHOT or a similar window capture package.

HIGH PERFORMANCE EXPANSION CAPABILITY
The DAS 92E9 expansion chassis is used to expand the number of instrument card slots, available with a DAS mainframe. The expansion chassis includes an expansion receiver card and cabling, and offers eight additional instrument card slots. A system maximum of 28 card slots are available in a fully expanded system consisting of one mainframe and three DAS 92E9 expansion chassis.

SYMBOLIC PERFORMANCE ANALYSIS
With increasingly complex software, speed and size become harder to manage. When software begins to bog down, you need to know where it's spending its time. With 92PA Performance Analysis, you can chart the ranges where software is running. The screen updates rapidly and data can be sorted while running. A histogram of the execution time of a particular event can be displayed with minimum, maximum and average values continuously updated.

Data can be sorted into 5000 ranges, so everything can be measured in one pass. Data for the ranges can be imported directly from your compiler, easing the definition of ranges. The output of the 92PA can be saved as an ASCII file for later analysis.

PATTERN GENERATION AT UP TO 100 MHZ
For stimulus requirements you can choose between the 92S16/S32 and the 92SX109/SX118. These subsystems generate data rates of up to 50 MHz and 100 MHz respectively. Patterns can be output either sequentially or algorithmically using a command structure that includes subroutine calls. These pattern generators can be combined with any of the acquisition cards to provide powerful stimulus/response systems.

LONG TERM PRODUCT SUPPORT
Every DAS mainframe and instrument card is delivered to you with a full one year on-site service coverage. (This support may not be available in all geographic areas. Check with your local Tektronix sales engineer.) Service Options may be purchased to extend coverage to three or five years at the time you purchase your system.

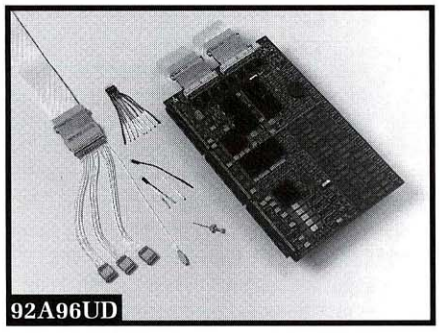
Digital Analysis System

92C96 • 92C96D • 92C96XD • 92C96SD • 92A96UD

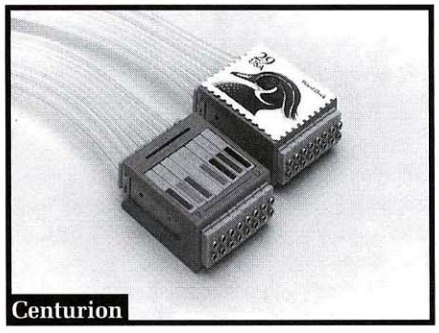
Features

CENTURION ACQUISITION MODULES INCLUDING THE 92A96UD MODULE

- PowerFlex™
- 96-384 Channels @ 100 MHz Sync or Async
- 400 MHz Async
- 100 MHz Clocking State Machine Tracks Fast, Complex Buses
- 100 MHz, 16 State Triggering State Machine
- 100 MHz Time Stamp
- Available in 8 K to 8 M Memory Depths
- Time-Correlated to Other State/Timing Modules
- Bus-Form Timing Display
- Compact, High Bandwidth Probes
- Provides Timing Analysis Through Same Probes
- Compatible with TLA510 logic analyzers



The 92A96UD offers memory depth of 8 M Bits per channel.



The Centurion family of modules provide accessibility to signals with 8-channel probes as small as a U.S. postage stamp.

State Analysis or Microprocessor Support

For high-speed state analysis or microprocessor support, the solution is the family of 92C96 Centurion acquisition cards. The 92C96 acquisition module of various depths handles clock and bus rates up to 100 MHz without compromising any performance features and is available with synchronous acquisition memory depths of 8 K, 32K, 128 K, 512 K, or 2 M. The 92C96 Centurion is 96 channels wide and can be extended to 384 channels in one mainframe.

TIMING AND HIGH-SPEED STATE ANALYSIS

In timing mode, 92C96 modules can be expanded to a system total of 1536 channels, with 100 MHz sampling on all channels. These cards can also sample at up to 400 MHz on a reduced number of channels. There are no speed or memory compromises when you add time stamping or select disassembly.

Instrument Module Selection Guide

The following instrument cards include probes. A maximum of seven instrument cards may be installed in a DAS mainframe, depending on the cards. A maximum of eight instrument cards may be installed in a DAS 92E9 expansion mainframe, depending on the cards. Each mainframe includes sufficient power for all card slots. Additional options are available.

MODULE TYPE

Acquisition	Description	Fastest Internal Clock	Fastest External Clock	Maximum per Card	Channels per System	Memory Depth (per CH)
92C96	Master or Expander	2.5 ns	10 ns	96	1,536	8 K
92C96D	Master or Expander	2.5 ns	10 ns	96	1,536	32 K
92C96XD	Master or Expander	2.5 ns	10 ns	96	1,536	128 K
92C96SD	Master or Expander	2.5 ns	10 ns	96	1,536	512 K
92A96UD	Master or Expander	2.5 ns	10 ns	96	1,536	2 M
Pattern Generator						
92S16	Algorithmic	20 ns	20 ns	18	936	1 K
92S32	Sequential or Expander	20 ns	20 ns	36	1008	8 K
92SX109	Algorithmic	10 ns	10 ns	9	468	2 K
92SX118	Sequential or Expander	10 ns	10 ns	18	504	16 K

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Analysis System
DAS® 9200 • DAS® NT • DAS® XP

WHY HIGH BANDWIDTH PROBES?
Probes are the highest volume component in a logic analyzer and represent a large fraction of the total cost. Probes for the 92C96 use precision NiCR coax and hybrids embedded in the podlets. The specifications are at the probe tip, not at the connector on the acquisition card. Tektronix probes will not add to the uncertainty in your system under test.

The 92C96 has analog bandwidth greater than 150 MHz and can easily handle 100 MHz synchronous acquisition with a setup and hold window of 5 ns.

CONNECT PROBES ONCE!
Probes for logic analyzers are usually optimized for large channel counts at the expense of performance, which makes it difficult to perform timing analysis on the large number of channels necessary for state analysis. The compact 8-CH probes of the 92C96 allow convenient connection to wide buses without compromising timing performance. You can connect to a microprocessor bus for state analysis with disassembly and change to fast asynchronous bus timing without switching probes!

WHY DEEP MEMORY?
In most situations, triggering starts on a visible symptom of a problem. With microprocessor-based designs, the cause of a problem is often separated from the symptom by a long period of time and a lot of bus activity. To trace the cause of the symptom, you need to go backward in acquisition memory to the time of the cause. Only a deep trace buffer with full trigger positioning can prepare you for this kind of problem.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

PowerFlex™ UPGRADES

92FXNET
Upgrades DAS 9219/9220 Mainframe to Workstation Compatible (DAS NT).
Includes: 92FXSE and DAS NT Software.

92FXSE
Upgrades DAS 9219/9220 Mainframe to (DAS XP).
Includes: CPU card, DAS/OS, 1.2 GB HDD, X Terminal, and 3.5 in. Floppy Disk Drive.

9206XT
15 in. X Terminal and DAS XP Software.
Opt. 4X – 17 in. X Terminal and DAS XP Software.

92F11
3.5 in. Floppy Disk Drive.

92LANSE
Ethernet LAN Interface.

92C96 UPGRADES
LAF01 – 8 K to 32 K memory upgrade.
LAF02 – 8 K to 128 K memory upgrade.
LAF03 – 8 K to 512 K memory upgrade.
LAF04 – 32 K to 128 K memory upgrade.
LAF05 – 32 K to 512 K memory upgrade.
LAF06 – 128 K to 512 K memory upgrade.

92C02 COMMUNICATION INTERFACE
GPIB/Mainframe Expansion Interface.

DAS ACQUISITION CARDS
92C96 – 8 K Deep Card.
92C96D – 32 K Deep Card.
92C96XD – 128 K Deep Card.
92C96SD – 512 K Deep Card.
92A96UD – 2M Deep Card.

92C96 CENTURION OPTIONS
Opt. 1P – Additional general purpose accessories.
Opt. 4S – Substitute coax probe cables.

DAS MAINFRAMES

DAS NT
Networked System Analyzer Mainframe.
Includes: 40 MHz CPU, 16 MB RAM, 1.2 GB Hard Disk, 1.4 MB Floppy Drive and Ethernet LAN Interface.

DAS XP
Standalone System Analyzer Mainframe.
Includes: 40 MHz CPU, 16 MB RAM, 1.2 GB Hard Disk, 1.4 MB Floppy Drive, X Terminal and Ethernet LAN Interface.

DAS 92E9
8 Card Slot Expansion Mainframe.

OPTIONS COMMON TO ALL DAS MAINFRAMES
Opt. 04 – EMI Shielding.
Opt. 05 – Rackmount Kit.
Opt. 1A – 115 V/15 A Power Cord.
Opt. 1B – 125/208 V 3-Phase Power Supply.
Opt. 18 – Sub. Removable HD for Std. HD.
Opt. 2C – GPIB/Expansion Interface (92C02).
Opt. 4X – Sub. 17 in. X Terminal.

DAS PATTERN GENERATOR CARDS

92S16
18-CH, 50 MHz Algorithmic Pat. Gen., 1 K Deep..
Includes: Two P64643A Probe and Leads.
Opt. 2S – Sub. Two P6465 Probes for Two P64643A Probes.

92S32
36-CH, 50 MHz Sequential Pat. Gen., 8 K Deep.
Includes: Four P64643A Probes and Leads.
Opt. 1S – Sub. One P6465 Probe for One P64643A Probe.
Opt. 2S – Sub. Four P6465 Probes for Four P64643A Probes.

92SX109
9-CH, 100 MHz Algorithmic Pat. Gen., 2 K Deep.
Includes: One Pat. Gen. Multiplexer, and One P6465 Probe and Leads.
Opt. 09 – Add One P6465 Output Data Probe.
Opt. 11 – Add One P6460 External Control Probe.

92SX118
18-CH, 100 MHz Sequential Pat. Gen., 16 K Deep .
Includes: Two Pat. Gen. Multiplexers, and Two P6465 Probe and Leads.
Opt. 09 – Add Two P6465 Output Data Probe.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
Opt. S3 – Three year upgrade to "On-site" Service.
Opt. S5 – Five year upgrade to "On-site" Service.
Opt. IN – Product Installation Service.
See page 581 for further information.

Note: Opt. 88, Factory Installation and Test, is a no charge option available for all DAS instrument cards ordered with a **new** mainframe.

Note: On-site installation is also available as an option to your system. When you purchase on-site installation, the service technician will:
- Set up and configure your system.
- Configure and integrate all optional accessories.
- Run diagnostics to completely verify functionality.

ADDITIONAL ACCESSORIES
Logic Analyzer Cart – Order LA Cart.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

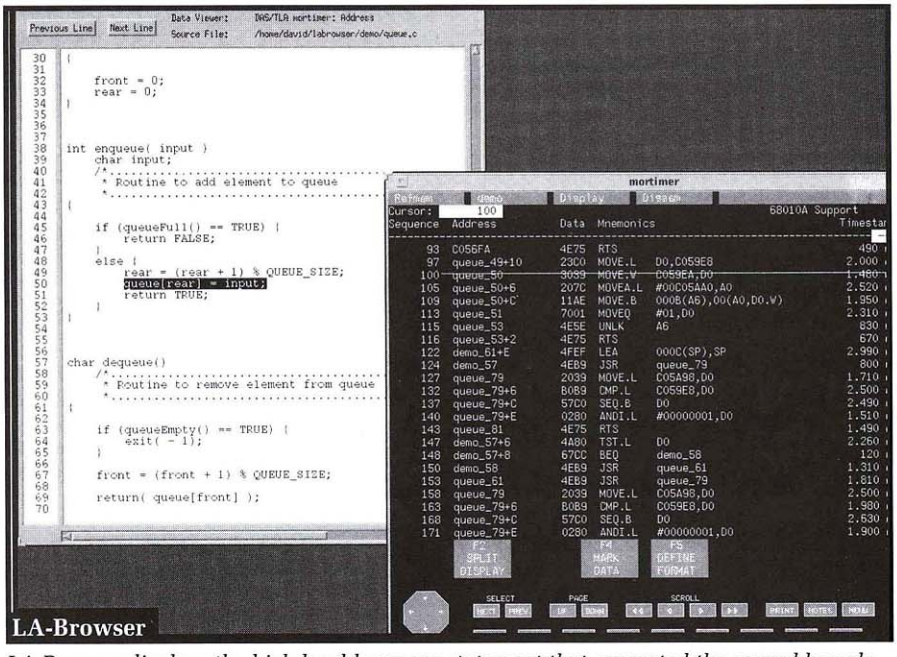
Tektronix Measurement products are manufactured in ISO registered facilities.

High Level Language Browser Software

LA-Browser™

Features

- Correlate High Level Language Statements to Disassembly Display
- Supports C, C++, Ada, Pascal, FORTRAN, and Others
- Compatible With All DAS/TLA 500 Supported Microprocessors
- Runs On-line With DAS/TLA 500 Logic Analyzers or Off-line With LA-OffLine™
- Scroll by High Level Statement
- Scroll by Assembly Level Statement
- Trace Real-time Activity by Source Code Statement



LA-Browser displays the high level language statement that generated the assembly code displayed by the logic analyzer. This shows LA-Browser and the DAS/TLA interface being used together.

Source Code Tracing of Logic Analyzer Data

LA-Browser is a host based software product that works with Tektronix Enterprise logic analyzers, the DAS® System and TLA 500 Series and with Tektronix LA-OffLine data analysis software. One window displays the traditional DAS/TLA 500 interface with the disassembly display. LA-Browser software opens a second window which displays the original source code. These two windows are synchronized, so that as you scroll through the acquired data in the logic analyzer display, the LA-Browser display highlights the corresponding source code statement.

This revolutionary product will greatly improve the efficiency of your hardware/software integration and software debug task by letting you work at the source code level in which you wrote your program. You no longer need to manually translate assembly language back to the original source code when using your logic analyzer.

MOST MAJOR COMPILERS ARE SUPPORTED

LA-Browser software extracts the information it needs from the load file generated by the compiler. When your program is compiled with "debug" turned on, additional information is generated and stored in the load file. When you tell the LA-Browser software the name of your load file, it extracts the information it needs.

Compilers generate several common formats. LA-Browser software supports IEEE695, OMF86, OMF386, and new formats are constantly being added. If your compiler does not generate these formats, the LA-Browser program has an ASCII format that it can read.

Tektronix is working with major compiler vendors to verify LA-Browser software compatibility with their compilers. Check to see if your compiler vendor is a Tektronix partner and if not, have them contact Tektronix to become a marketing partner.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

LA-Browser
Source Code Browser for DAS/TLA Logic Analyzers and LA-OffLine.

Opt. 01 – SUN Based Software, Single License.
Opt. 05 – SUN Based Software, 5 Licenses.
Opt. 08 – SUN Based Software, Site License.
Opt. 11 – PC Based Software, Single License.
Opt. 15 – PC Based Software, Five Licenses.
Opt. 18 – PC Based Software, Site License.
Opt. 41/45/48 – Software Subscription Service.

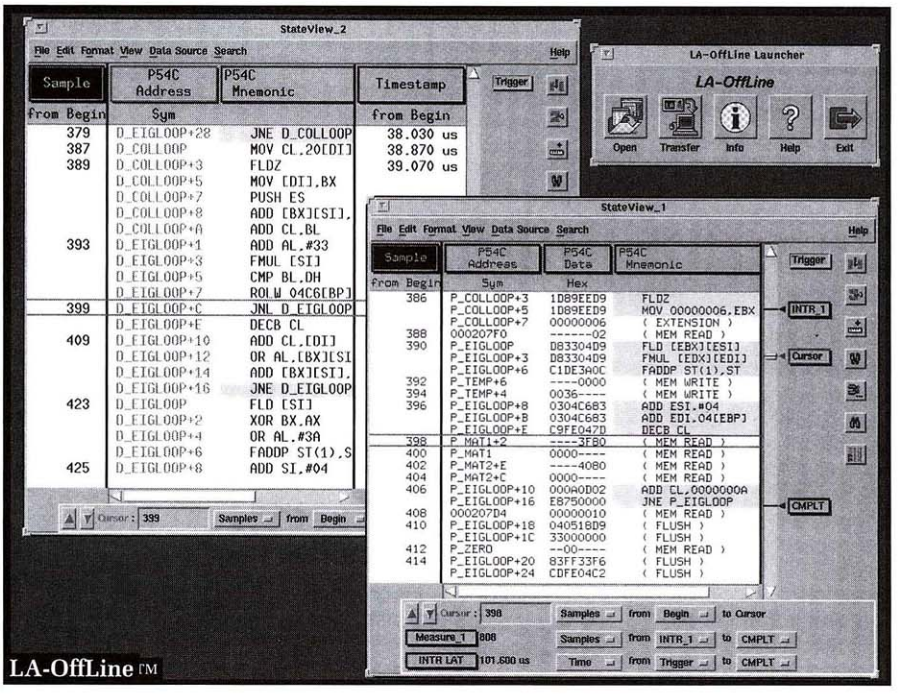
Offline Analysis Software

LA-OffLine™

Features

LA-OffLine

- Free the Logic Analyzer for Other Users
- Microsoft Windows User Interface on PC
- Full X11/Motif User Interface on Sun
- PC Windows 3.1 Interface
- Takes Advantage of the Workstation Computation Capabilities
- Automated Upload from the Logic Analyzer
- Wide Range of Microprocessor Support Included
- Multi-window and Multiprocessor Support
- Flexible Symbolic Data Search



LA-OffLine – Free up the DAS/TLA 500 Logic Analyzer

The LA-OffLine software operates completely independent of the instrumentation. Once the data is acquired it can be automatically uploaded to one or more workstations or PCs for independent analysis.

LA-OffLine software is compatible with any SUN SPARCstations and Microsoft Windows 3.1 based PCs. LA-OffLine software supports 92A96 or 92C96 acquisition data from either DAS® or TLA 500 systems.

ROBUST DATA ANALYSIS CAPABILITY

The X-windows and Microsoft Windows 3.1 environment offers rich data analysis capability. The data may be displayed in multiple windows using different display formats, window sizes and fonts. Correlated acquisitions are displayed in multiple windows with the cursors locked together in time.

LA-Browser™ COMPATIBILITY

When used with LA-Browser software, you can analyze your data at both the assembly level and the high level language level (e.g., C, C++, Pascal, Ada).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

All listed application software is compatible with TLA and DAS instruments.

LA-OffLine
Offline Disassembly Analysis Software.

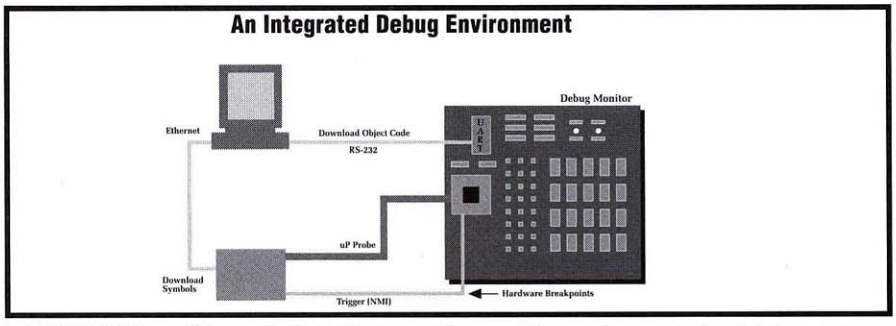
Opt. 01 – Single Sun License.
Opt. 05 – 5 User Sun License.
Opt. 08 – Site Sun License.

Opt. 11 – Single PC License.
Opt. 15 – 5 User PC License.
Opt. 18 – Site PC License.

Applications Software
92PORT • 92LANP

Features

APPLICATIONS SOFTWARE
- Remote Prototype Control
- Links to Software Debug Packages
- Links to Logic Simulators
- Remote Batch Programming Over LAN



LA-CONNECT combines a logic analyzer, a debug monitor, and a source level debugger to provide a real-time debug environment for today's fastest and most complex microprocessors.

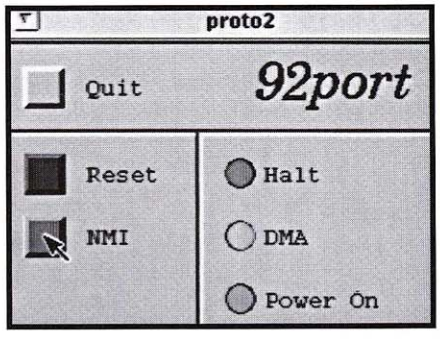
LA-CONNECT™ – An Alternative to In-circuit Emulation

To maximize the functionality of your logic analyzer, Tektronix has teamed up with leading vendors of embedded software development tools to integrate the logic analyzer into their environment. This approach, called LA-CONNECT, combines tools that you may already be using into a cost effective debug environment with functionality that exceeds many emulators. LA-Browser™ software adds high level language debug capability to your logic analyzer enabling you to trace real-time activity in C, C++, Pascal, or Ada.

By combining a debug monitor, a source level debugger and a logic analyzer, a user can sit at a workstation screen and control all of his tools, including the logic analyzer. Tools are available to allow full remote debugging completely over the local area network.

FULL REMOTE CONTROL OVER LAN ETHERNET
The 92LANP applications software provides full remote programming of DAS® and TLA 500 systems with the Tektronix Control Language (PCL). Setup, control, status, patterns and results can be exchanged over LAN.

LINKS TO LOGIC SIMULATORS
The CADLINK application software provides a link between logic simulation software data and the DAS stimulus and acquisition instrumentation. The 92SIMLK application software offers translations for specific simulator outputs. The acquired data can be compared to the expected results on the DAS system.



CONTROL YOUR TARGET SYSTEM FROM THE WORKSTATION
The 92PORT application software provides control and monitoring of the target system. Eight output bits and eight input bits are displayed in an X-window as soft "buttons" or indicators. With this, static functions of the target system can be controlled or monitored, e.g., RESET or INTERRUPT and READY or FAULT. Each indicator and button can be individually labeled and programmed for the desired logic sense and function.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

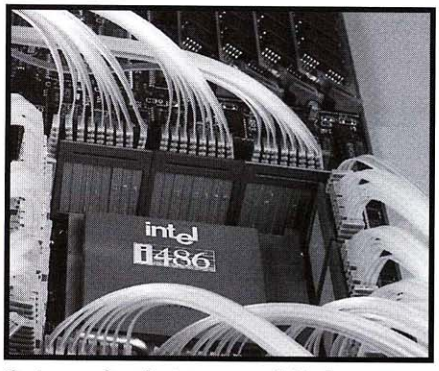
Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

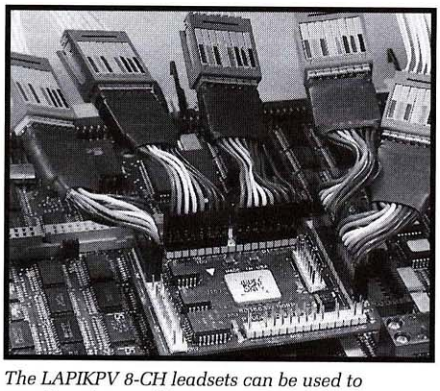
For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

92PORT – DAS Target Control Software.
CADLINK – Simulation Vector Sampling Software.
92SIMLK – Simulation Translation Software.
92LANP – LAN Control Language (PCL) SW.
92PA – Performance Analysis Software.

Logic Analyzer Microprocessor Support



Custom probe adapters are available for probing today's dense microprocessor package styles. This shows a PGA probe adapter for the Intel 80486 family.



The LAPIKPV 8-CH leadsets can be used to provide a low-profile connection between your Logic Analyzer probes and your System Under Test (SUT).

Timely Support of the Newest Devices

As microprocessors become an increasingly critical factor in system design time and product differentiation, the proliferation of new microprocessor devices is growing explosively. The most important question in the minds of many designers is, "If I use the latest processor, can I find the development tool support I need?"

Tektronix is committed to delivering timely support of key devices as they appear in the market. This is accomplished through close cooperation with microprocessor vendors, beginning long before the latest devices are fabricated.

Highly integrated hardware and software development techniques and a wide variety of design channels ensure the ability to respond to your unique requirements. The Tektronix factory, OEM suppliers, customer technical support and independent contractors are all sources of microprocessor and bus support products.

CONNECTING TO YOUR DEVICE? – NO PROBLEM WITH TEKTRONIX PROBE ADAPTERS AND ACCESSORIES

There are two methods for connecting to the processor: (1) custom probe adapters, (2) general purpose probing.

Custom Probe Adapters offer a quick and reliable connection to your microprocessor. Tektronix offers a variety of custom probe adapters for a wide assortment of soldered or socketed package styles including DIP, PLCC, LCC, PGA, PQFP (JEDEC) and CQFP (JEDEC).

Each signal on the probe adapter has an adjacent ground pin connected to an internal ground which keeps noise and crosstalk to a minimum. If vertical height is a concern, low profile connections are available (LAPIKPV).

General Purpose Probing allows you to connect to test pins on your prototype or to your own custom test clip when a custom probe adapter is not available.

Tektronix podlets with 100 mil spacing easily interface to a wide variety of test clips and probing accessories. You can use the podlets either individually with a podlet ground lead or in groups of eight with an 8-CH podlet holder.

Time-stamping with No Trade-offs. Each acquisition sample includes a time stamp stored with 10 ns resolution. There is no decrease in resolution or overflow for measuring events as long as two days. No memory depth is compromised. Several formats of time stamp display make it easy to measure relative timing of multiple complex events.

Powerful Clocking State Machine. The Tektronix clocking state machine makes the most efficient use of acquisition memory possible by qualifying data and tracking complex bus cycles.

Simultaneous State and Timing Through a Single Probe. If you need to look at individual signals on the microprocessor, you simply change the time base. *This is done without moving probes or double probing.*

VIEWING YOUR DATA – TEKTRONIX DOES THE WORK FOR YOU

Tektronix logic analyzers offer the most powerful disassembly in the industry.

Four Modes of Disassembly:

- **Hardware Display –** shows all bus cycles. Automatically disassembles executed instructions and shows unexecuted instructions as FLUSHED.
- **Software Display –** shows only executed instructions. Unexecuted instructions are filtered out.
- **Control Flow Display –** shows instructions that change the flow of your program such as branches, jumps, and returns instructions.
- **Subroutine Display –** shows only subroutine call and return instructions.

Microprocessor support packages come standard with setup software that fully configures the analyzer with individual signal names, channel grouping, comprehensive state clocking and symbol files for bus cycle, simplifying triggering and data display.

THE MOST USEFUL DATA ACQUISITION IN THE INDUSTRY

Once connected to your microprocessor, you need to consider what impact the logic analyzer has on your systems. The Tektronix probing system is the best in the industry with many advantages over other analyzers.

- Extremely low AC Loading
- Ability to acquire both state and timing data through the same probe connections
- Probes are small and lightweight to probe 2 mil square pins.
- Color coded for easy podlet identification

Most microprocessors do not need all of the acquisition channels. These unused channels can be used to probe other parts of your system under test.

Logic Analyzers
Microprocessor and Bus Support

Device	TLA 700	DAS® and TLA 500
AMD		
Am80386DX	X	X
Am80486DX	X	X
Am80486DX2	X	X
Am80486SX	X	X
Am80486SX2	X	X
29000	X	X
29050	X	X
29205	X	X
29030	X	X
29035	X	X
29040	X	X
AT&T		
DSP3210		X
Cypress Semiconductor		
CY7C601 Sparc		X
Digital Equipment Corp.		
Alpha AXP 21064	X	X
Fujitsu		
MB86903 Sparc		X
IBM		
PPC601	X	X
PPC603	X	X
PPC603e	X	X
PPC604	X	X
IDT (Integrated Device Technologies)		
R3XXX	X	X
R4XXX	X	X
Intel		
8031	X	X
8032	X	X
8051	X	X
8052	X	X
80C152	X	X
80C452	X	X
80515	X	X
80532	X	X
80535	X	X
83C152	X	X
83C452	X	X
83C537	X	X
8096BH	X	X
8097JF	X	X
8397BH	X	X
8397JF	X	X
8797BH	X	X
8797JF	X	X
80C196KC	X	X
80C196KD	X	X

Device	TLA 700	DAS® and TLA 500
87C196KC	X	X
87C196KD	X	X
80C196NP	X	X
80C196NT	X	X
8085		X
8086	X	X
80C86	X	X
8088	X	X
80C88	X	X
80186	X	X
80C186	X	X
80C186XL	X	X
80C186EA	X	X
80C186EB	X	X
80188	X	X
80C188	X	X
80C188XL	X	X
80C188EA	X	X
80C188EB	X	X
80286	X	X
80386EX	X	X
80386SX	X	X
80386DX	X	X
80486SX	X	X
80486DX	X	X
80486DX2	X	X
80486DX4	X	X
80487SX	X	X
Pentium-60/66	X	X
Pentium-75-150	X	X
P54C	X	X
P54CM	X	X
P54CS	X	X
P55C	X	X
APIC Bus	X	X
Pentium Pro	X	X
80960KA		X
80960KB		X
80960MC		X
80960CA	X	X
80960CF	X	X
80960Jx	X	X
80960Hx	X	X
80960Rx	X	X
LSI Logic		
64811 Sparc		X
LR33000/050		X
R3XXX	X	X
R4XXX	X	X

Logic Analyzers
Microprocessor and Bus Support

Device	TLA 700	TLA500 or DAS®
MIPS/Silicon Graphics (incl. IDT, LSI Logic, NEC, Performance Semiconductor, Siemens, Toshiba)		
LR33000/050		X
R36100		X
R3000		X
R3051	X	X
R3052	X	X
R3081	X	X
R4000	X	X
R4100	X	X
R4200	X*1	X*1
R4300	X*1	X*1
R4400	X	X
R4600	X*1	X*1
R4640	X*1	X*1
R4700	X*1	X*1
R5000	X*1	X*1
Motorola		
68HC11		X
68HC16		X
68HC16EVB		X
68302		X
68331	X	X
68332	X	X
68332EVS	X	X
68340	X	X
68360	X	X
68000	X	X
68010	X	X
68020	X	X
68030	X	X
68040	X	X
68060	X	X
MPC601	X	X
MPC603	X	X
MPC603e	X	X
MPC604	X	X
NEC		
R3XXX		X
R4XXX	X	X
V25		X

Device	TLA 700	TLA500 or DAS®
Performance Semiconductor		
R3XXX	X	X
R4XXX	X	X
Siemens		
80C166		X
80C167	X	X
Texas Instruments		
TMS32020		X
TMS320C25		X
TMS320C26		X
TMS320C2xLP		X
TMS320C2xx		X
TMS320C30	X	X
TMS320C31	X	X
TMS320C32		X
TMS320C40		X
TMS320C50		X
TMS320C51		X
Toshiba		
R3XXX	X	X
R4XXX	X	X
Zilog		
Z80	X	X
Bus Support		
SCSI I/II	X	X
USB	X*1	X*1
VME	X*2	X*2
ISA	X*2	X*2
EISA	X*2	X*2
Micro Channel	X*2	X*2
PCI	X*2	X*2
PCMCIA	X*2	X*2
PCI 32-Bit Short card	X*2	X*2
72-Pin SIMM	X*2	X*2
Mezzenine PCI	X*2	X*2

**1 Contact: Crescent Heart Software,3529 Northeast Bryce Street, Portland, Oregon 97212-1854, Tel No. 503-287-5422, Fax No. 503-287-5430, E-mail dkj@c-h-s.com, Web Site: http://www.teleport.com/~chschs.*

**2 Contact: New Wave PDG, 59 Davis Ave., Norwood, Massachusetts 02062, Tel No. 603-595-8116, Fax No. 617-762-9445, E-mail busboards @AOL.COM, Web Site: http://www.busboards.com*

RF and Wireless Test Products

Tektronix RF and Wireless Test Capabilities Cover a Broad Spectrum!

Tektronix offers a value-packed line of RF, microwave and wireless communication test products. The list includes a wide selection of spectrum analyzers, signal generators, network analyzers, communications test sets, and power meters, along with complementary ancillary equipment and software. For further information on specific products, refer to the following catalog pages.

CONTENTS

SPECTRUM ANALYZERS 145
NETWORK ANALYZERS 200
POWER METERS 205
SIGNAL GENERATORS 219
EMI/RFI SOLUTIONS 237
WIRELESS COMMUNICATION TEST SETS 268

RF and Wireless Test Products

Applications

- Avionics
- Bio-Medical
- Cable TV
- Common Carrier
- Design and Development
- Education
- EMC
- EW
- Manufacturing Test
- Millimeter Wave R & D
- Radar
- Research
- Satellite Communication
- Service
- TV/Radio Broadcasting
- Wireless Communications

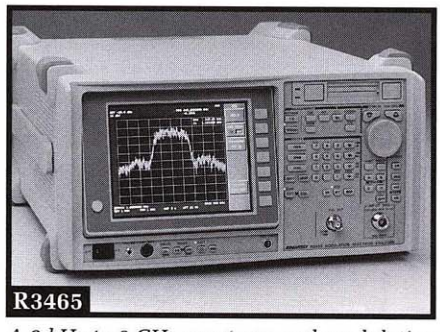
Tektronix Wireless Communication Microwave and RF Products – At Home Where Your Measurements Are!

- In the lab, in the field
- On the manufacturing floor

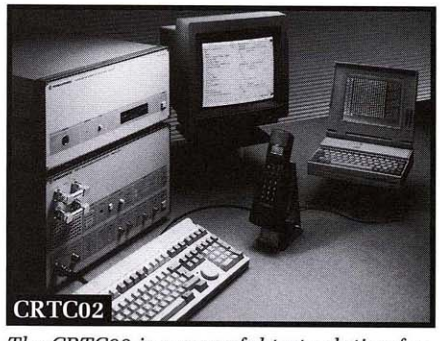
Tektronix products cover a broad spectrum of applications in the time and frequency domain – Bio-medical, Cable TV, Education, EMC, Design and Development, Manufacturing Test, Research, Service, Satellite Communication, to name only a few.

We can only show a few of the hundreds of applications here. For information about Tektronix solutions to your microwave and RF or other test needs, call your local Tektronix sales representative or call (800) 426-2200.

Tektronix spectrum analyzers offer solutions for all phases of EMC testing. The 2712 shown here is available as part of the 27120 EMC Pre-/Post-Certification Measurement System which provides a comprehensive and affordable means of significantly improving the probability of formal EMC certification on the first try. The system is designed for testing to FCC, VDE, VCCI, EC, and other EMC requirements.



A 9 kHz to 8 GHz spectrum and modulation analyzer for digital mobile communications featuring I/Q origin offset, error vector magnitude, phase error, frequency error, and code domain power measurements. The R3465 is a one-platform solution for CDMA, NADC, PDC, PHS, or GSM measurements at cellular or PCS frequencies.



The CRTC02 is a powerful test solution for the GSM/DCS1800/PCS1900 mobile phone or IC developers. As well as layer 1 physical measurements, the CRTC02 provides detailed layers 2 and 3 protocol analysis.

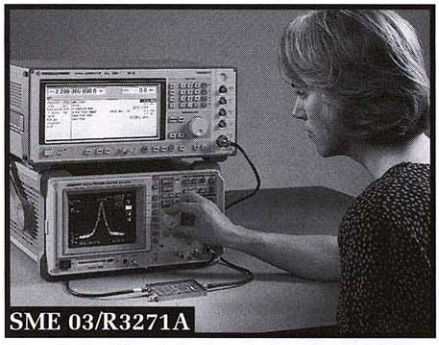
The SMIQ signal generator covers a frequency range from 300 kHz to 3.3 GHz. With superior modulation accuracy and excellent spectral purity, this sets a new standard for digital modulation applications.

The lightest weight and smallest size of any spectrum analyzer in its class, the U3641 features coverage to 3 GHz, high sensitivity, a synthesized local oscillator, and color display. Furthermore, the U3641 operates from AC, DC, or optional battery power for true flexibility in a 15 lb. package.

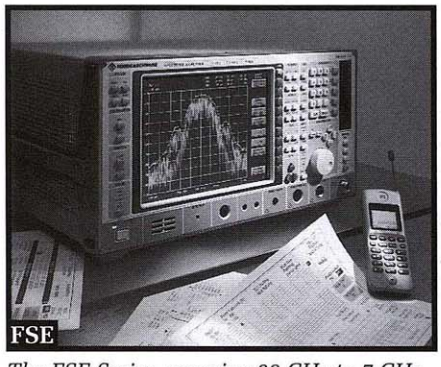
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

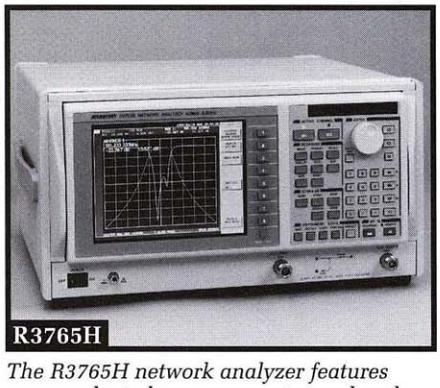
RF and Wireless Test Products



Simulating burst transmission (TDMA) is critical for cellular system design. The engineer shown here is using the SME03 Signal Generator and R3271A Spectrum Analyzer designed for burst transmission simulation and recovery.



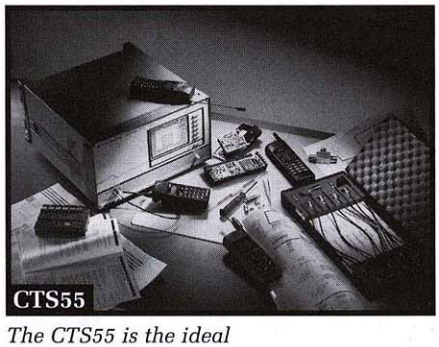
The FSE Series, covering 20 GHz to 7 GHz with its range of modular options, provides an ideal measurement platform for spectrum, time, and modulation domain measurements.



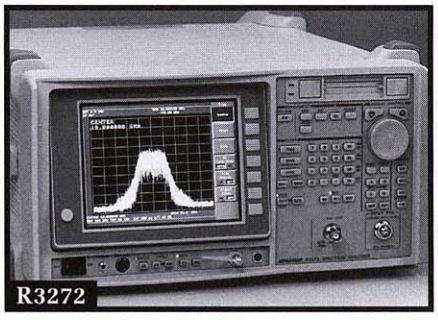
The R3765H network analyzer features unprecedented measurement speed and productivity enhancements. It is designed specifically for testing components in RF and wireless communications (cellular phones, pagers, cordless phones, etc.)

The CMD Series provides the ideal one-box solution for testing digital mobile radio equipment – CDMA, GSM, DCS 1800, DCS 1900.

A low-cost and efficient solution for point-of-sale or incoming inspection go/no-go checks on SM/DCS1800/PCS1900 mobile phones.



The CTS55 is the ideal GSM/DCS1800/PCS1900 mobile station test set for use in repair applications network operators, and independent repair center. It will same time and money with its combination of Quick Test, Auto Test and Manual Test.



A compact design and frequency range of 9 kHz to 26.5 GHz makes the R3272 ideal for point-to-point microwave and satellite link manufacture, installation, and maintenance. Measurements are accurate and simple with the R3272's color, menu-driven display and its automatic functions.

Cable TV proof-of-performance measurements in the field have never been easier. With the 2714 or 2715 Cable TV Spectrum Analyzer, all commonly needed cable TV measurements can be preconfigured for simple push-button execution and data collection. High portability allows the automatic measurement power to be applied anywhere in the field. Back at the office, measurements can be downloaded from memory to the accompanying PC software for report generation.

SPECTRUM ANALYZER SELECTION GUIDE

Specifications	FSEK30	FSEK20	FSEM30	FSEM20	R3271A R3371A	R3272
Frequency Range	20 Hz to 40 GHz	9 kHz to 40 GHz	20 Hz to 26.5 GHz	9 kHz to 26.5 GHz	100 Hz to 26.5 GHz	9 kHz to 26.5 GHz
Frequency Measurement Accuracy (Aging)	50 Hz @ 40 GHz CF	40.01 kHz @ 40 GHz CF	30 Hz @ 20 GHz CF	20.01 kHz @ CF 20 GHz CF	±211 Hz @ 10 GHz CF	±245 Hz @ 10 GHz CF
Resolution BW Range	1 Hz to 10 MHz 1, 2, 3, 5 Sequence	10 Hz to 10 MHz 1, 2, 3, 5 Sequence	1 Hz to 10 MHz 1, 2, 3, 5 Sequence	10 Hz to 10 MHz 1, 2, 3, 5 Sequence	10 Hz to 3 MHz 1, 3, 10 sequence	300 Hz to 3 MHz, 5 MHz 1, 3, 10 sequence
Residual FM	–	–	–	–	3 Hz	<(3 Hz x N_{p-p}/0.1 s)
Phase Noise	-114 dBc/Hz @ 500 MHz CF, 10 kHz offset	-90 dBc/Hz @ 500 MHz CF, 10 kHz offset	-114 dBc/Hz @ 500 MHz CF, 10 kHz offset	-90 dBc/Hz @ 500 MHz CF, 10 kHz offset	–102 dBc/Hz @ 10 GHz CF, 10 kHz offset	–98 dBc/Hz @ 7.5 GHz CF, 10 kHz offset
CRT Display Range	200 dB	200 dB	200 dB	200 dB	100 dB	100 dB
Frequency Response	+/-1 dB total to 1 GHz total measurement error	+/-1 dB total to 1 GHz total measurement error	+/-1 dB total to 1 GHz total measurement error	+/-1 dB total to 1 GHz total measurement error	±4.0 dB 15.4 to 26.5 GHz	±4.0 dB 15.4 to 26.5 GHz
Sensitivity	-148 dBm	-138 dBm	-148 dBm	-138 dBm	–123 dBm @ 10 GHz CF	–108 dBm @ 10 GHz CF (typical)
Environmental	+5 to +40° C	+5 to +40° C	+5 to +40° C	+5 to +40° C	MIL-T-28800 Class 5	0 to 50°C ≤85% RH
Weight	25.8 kg (56.8 lb)	24.4. kg (53.7 lb)	25.2 kg (55.4 lb)	23.8 kg (52.4 lb)	22 kg (48.5 lb.)	16.5 kg (36 lb.)
Features/Options						
Markers	8	8	8	8	8	10
Tracking Generator	Yes	Yes	Yes	No	Yes, R3371A	No
Card Reader/Floppy Disk	Yes, Floppy	Yes, Floppy	Yes, Floppy	Yes, Floppy	Yes, Card	Yes (2) PCMCIA
Preamplifier	No	No	No	No	No	No
Quasi Peak Detector	No	No	No	No	Yes	No
CISPR Bandwidths	No	No	No	No	Yes	No
Frequency Counter	Yes	Yes	Yes	Yes	Yes	Yes
Analog Display	Yes (Quasi)	Yes (Quasi)	Yes (Quasi)	Yes (Quasi)	Yes, Pseudo Analog	No
75 Ω Input	No	No	No	No	No	No
AM/FM Demodulator	Yes	Yes	Yes	Yes	Yes	Yes
Modulation Analysis	Yes (Opt. 07)	Yes (Opt. 07)	Yes (Opt. 07)	Yes (Opt. 07)	Yes, R3541C	No
GPIB	Yes	Yes	Yes	Yes	Yes	Yes
RS-232	Yes	Yes	Yes	Yes	No	Yes
Page	152	152	152	152	161	165

SPECTRUM ANALYZER SELECTION GUIDE

Specifications	R3265A R3365A	R3465	FSEB30	FSEB20	FSEA30	FSEA20
Frequency Range	100 Hz to 8 GHz	9 kHz to 8 GHz	20 Hz to 7 GHz	9 kHz to 7 GHz	20 kHz to 3.5 GHz	9 kHz to 3.5 GHz
Frequency Measurement Accuracy	±112 Hz @ 5 GHz CF	±75 Hz @ 1 GHz CF	±11 Hz @ 1 GHz CF	±1.01 kHz @ 1 GHz CF	±11 Hz @ 1 GHz CF	±1.01 kHz @ 1 GHz CF
Resolution BW Range	10 Hz to 3 MHz 1, 3, 10 sequence	300 Hz to 3 MHz, 5 MHz 1, 3, 10 sequence	1 Hz to 10 MHz 1, 2, 3, 5 sequence	10 Hz to 10 MHz 1, 2, 3, 5 sequence	1 Hz to 10 MHz 1, 2, 3, 5 sequence	1 Hz to 10 MHz 1, 2, 3, 5 sequence
Residual FM	≤3 Hz	<3 Hz p-p/0.1 s	–	–	–	–
Phase Noise	–108 dBc/Hz @ 8 GHz CF, 10 kHz offset	–100 dBc/Hz @ 10 kHz offset	–114 dBc/Hz @ 500 MHz CF, 10 kHz offset	–90 dBc/Hz @ 500 MHz CF, 10 kHz offset	–120 dBc/Hz @ 500 MHz CF, 10 kHz offset	–96 dBc/Hz @ 500 MHz CF, 10 kHz offset
CRT Display Range	100 dB	100 dB	200 dB	200 dB	200 dB	200 dB
Frequency Response	±1.5 dB	±1.5 dB	±1 dB total to 1 GHz total power measurement error	±1 dB total to 1 GHz total power measurement error	±1 dB total to 1 GHz total power measurement error	±1 dB total to 1 GHz total power measurement error
Sensitivity	–135 dBm @ 5 GHz CF	–118 dBm (typical) @ 1 GHz CF	–152 dBm	–142 dBm	–155 dBm	–145 dBm
Environmental	MIL-T-28800 Class 5	0 to 50°C 85% RH	5 to 40°C	5 to 40°C	5 to 40°C	5 to 40°C
Weight	22 kg (48.5 lb.)	16 kg (35.3 lb.)	23 kg (50.6 lb.)	21.8 kg (48 lb.)	22.7 kg (49.9 lb.)	21.5 kg (47.3 lb.)
Features/Options						
Markers	8	10	8	8	8	8
Tracking Generator	Yes, R3365A	No	Contact your Tektronix representative	Contact your Tektronix representative	Yes	Yes
Card Reader/Floppy Disk	Yes, Card	Yes (2) PCMCIA	Yes, Floppy	Yes, Floppy	Yes, Floppy	Yes, Floppy
Preamplifier	No	No	No	No	No	No
Quasi Peak Detector	Yes	No	No	No	No	No
CISPR Bandwidths	Yes	No	No	No	No	No
Frequency Counter	Yes	Yes	Yes	Yes	Yes	Yes
Analog Display	Yes (Pseudo Analog)	No	Yes (Quasi)	Yes (Quasi)	Yes (Quasi)	Yes (Quasi)
75 Ω Input	No	No	No	No	No	No
AM/FM Demodulator	Yes	Yes	Yes	Yes	Yes	Yes
Modulation Analysis	Yes, R3541C	Yes	Yes, Opt. 07	Yes, Opt. 07	Yes, Opt. 07	Yes, Opt. 07
GPIB	Yes	Yes	Yes	Yes	Yes	Yes
RS-232	No	Yes	Yes	Yes	Yes	Yes
Page	161	167	152	152	152	152

SPECTRUM ANALYZER SELECTION GUIDE

Specifications	R3261D R3361D	R4131D	R3463	R3263	U3641/ U3641 N	R3261C/CN R3361C/CN
Frequency Range	9 kHz to 3.6 GHz	10 kHz to 3.5 GHz	9 kHz to 3 GHz	9 kHz to 3 GHz	9 kHz to 3 GHz	9 kHz to 2.6 GHz
Frequency Measurement Accuracy	40 Hz @ 1 GHz CF	100 kHz ±1 kHz @ 1 GHz CF	75 Hz @ 1 GHz CF	75 Hz @ 1 GHz CF	2.1 kHz @ 1 GHz CF	±40 Hz @ 1 GHz CF
Resolution BW Range	30 Hz to 1 MHz 1, 3, 10 sequence	1 kHz to 1 MHz 1, 3 sequence	300 Hz to 3 MHz (1, 3, 10 Sequence); 5 MHz	300 Hz to 3 MHz (1, 3, 10 Sequence); 5 MHz	1 kHz to 3 MHz (1,3 sequence, 100, 300 Hz option	30 Hz to 1 MHz 1, 3, 10 sequence
Residual FM	≤20 Hz	≤2 kHz_{p-p}	<3 Hz x N_{p-p}/0.1 s	<3 Hz x N_{p-p}/0.1 s	</=60 Hz x N_{p-p}/100 mS	≤20 Hz
Phase Noise	–105 dBc/Hz @ 3 GHz CF, 20 kHz offset	–110 dBc/Hz 20 kHz offset	–100 dBc/Hz @ 10 kHz offset	–100 dBc/Hz @ 10 kHz offset	–100 dBc/Hz @ 10 kHz offset	–105 dBc/Hz @ 3 GHz CF, 20 kHz offset
CRT Display Range	80 dB	80 dB	100 dB	100 dB	100 dB	80 dB
Frequency Response	±1 dB	±1 dB 100 kHz to 2 GHz	±-1.5 dB	±-1.5 dB	±2 dB	±0.5 dB
Sensitivity	–119 dBm @ 1 GHz CF	–116 dBm 10 kHz to 1	-118 dBm (typical) @ 1 GHz CF	-118 dBm (typical) @ 1 GHz CF	-138 dBm @ 1 GHz CF (typical,w/ Preamplifier)	–119 dBm @ 1 GHz CF
Environmental	MIL-T-28800 Class 5	0 to 50°C	0 to 50° C	0 to 50° C	0 to 50° C	MIL-T-28800 Class 5
Weight	11 kg (24.3 lb.)	10 kg (22 lb.)	17 kg (37.5 lb)	17 kg (37.5 lb)	6.9 kg (15.2 lb)	11 kg (24.3 lb.)
Features/Options						
Markers	2	2	10	10	6	2
Tracking Generator	Yes, R3361D	Yes, external TR4153A	No	No	Yes (option)	Yes, R3361C, R3361CN
Card Reader/ Floppy Disk	Yes, Card	No	Yes, PCMCIA Card (2)	Yes, PCMCIA Card (2)	Yes, PCMCIA Card (2)	Yes, Card
Preamplifier	No	Yes, external R14601	No	No	Yes	No
Quasi Peak Detector	Yes	Yes	No	No	No	Yes
CISPR Bandwidths	Yes	9 kHz, 120 kHz	No	No	No	Yes
Frequency Counter	Yes	No	Yes	Yes	Yes	Yes
Analog Display	No	No	No	No	No	No
75 Ω Input	No	Yes, R4131DN	No	No	Yes, U3641N	Yes, R3261CN
AM/FM Demodulator	Yes	No	Yes	Yes	Yes	Yes
Modulation Analysis	No	No	Yes	Yes	No	No
GPIB	Yes	Yes	Yes	Yes	Yes	Yes
RS-232	Yes, Opt.	No	Yes	Yes	Yes	Yes, Opt.
Page	173	177	167	167	179	173

SPECTRUM ANALYZER SELECTION GUIDE

Specifications	U4941/U4941N/U4342/4342N	2712	2714/2715	2711
Frequency Range	9 kHz to 2.2 GHz	9 kHz to 1.8 GHz	9 kHz to 1.8 GHz	9 kHz to 1.8 GHz
Frequency Measurement Accuracy	±50.2 kHz @ 1 GHz	±510 Hz @ 1 GHz CF	±510 Hz @ 1 GHz CF	±15 kHz @ 1 GHz CF
Resolution BW Range	1 kHz to 3 MHz 1, 3 sequence	300 Hz, 3 kHz 30 kHz, 300 kHz, 5 MHz	300 Hz to 5 MHz 1, 3, 10 sequence	3 kHz, 30 kHz, 300 kHz, 5 MHz
Residual FM	3 kHz p-p	≤100 Hz	≤100 Hz	≤2 kHz
Phase Noise	–100 dBc/Hz @ 1 GHz CF, 20 kHz offset	–97 dBc @ 1 GHz CF, 10 kHz offset	–97 dBc @ 1 GHz CF, 10 kHz offset	–97 dBc @ 1 GHz CF, 10 kHz offset
CRT Display Range	100 dB	80 dB	80 dB	80 dB
Frequency Response	±1.0 dB 100 kHz to 2 GHz	±1.5 dB	±1.5 dB	±1.5 dB
Sensitivity	–114 dBm –129 dBm with Preamp @ 1 GHz CF	–127 dBm, –139 dBm with Preamp @ 1 GHz CF	–78 dBmV, –90 dBmV with Preamp @ 1 GHz CF	–117 dBm, –129 dBm with Preamp @ 1 GHz CF
Environmental	0 to 50°C 85% RH	MIL-T-28800 Class 5	MIL-T-28800 Class 5	MIL-T-28800 Class 5
Weight	6.5 kg (14 lb.)	10 kg (22 lb.)	10 kg (22 lb.)	10 kg (22 lb.)
Features/Options				
Intelligent Markers	2	2	2	2
Tracking Generator	Yes U4342	Yes, Opt. 04 internal, Opt. 05 external	Yes, Opt. 05 external	Yes, Opt. 04 internal, Opt. 05 external
Card Reader/Floppy Disk	Yes, PCMCIA Card (2)	No	No	No
Preamplifier	Yes, internal	Yes	Yes	Yes
Quasi Peak Detector	Yes	Yes, Opt. 12	No	No
CISPR Bandwidths	9 kHz, 120 kHz	Yes, Opt. 12	No	No
Frequency Counter	Yes	Yes	Yes	Yes, Opt. 02
Analog Display	No	Yes	Yes	Yes
75 Ω Input	Yes, N Versions	Yes, external matching pad	Yes	Yes, external matching pad
AM/FM Demodulator	Yes	Yes	Yes	Yes
Modulation Analysis	No	No	No	No
GPIB	Yes	Yes	Yes, Opt. 03	Yes, Opt. 03
RS-232	Yes	Yes, Opt. 08 (N/C)	Yes, Opt. 08 (N/C)	Yes, Opt. 08(N/C)
Page	179	184	188	184

Spectrum Analyzers

FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

Features

FSEA20/30

- 9 kHz to 3.5 GHz (20 Hz to 3.5 GHz FSEA20)
- 10 Hz to 10 MHz RBW (1 Hz, FSEA30), Adjustable in 1-2-3-5 Steps
- –145 dBm Displayed Noise Floor (10 Hz RBW)
- –120 dBc/Hz Phase Noise at 10 kHz offset
- <1 dB Total Measurement Error up to 1 GHz
- 5 ms Full-span Sweep Time with Fully Synchronized Sweep
- 1 µs Zero-span Sweep Time
- Pretrigger, Trigger Delay, and Gated Sweep
- RMS Detection
- Eight Marker Functions for Direct Measurement (four absolute, four delta marker)
- Color TFT LCD Display (Standard FSEA30; Option 01 FSEA20)

FSEB20/30 Above features plus:

- 20 Hz to 7 GHz (9 kHz to 7 GHz FSEB20)
- –142 dBm Displayed Noise Floor (10 Hz RBW)
- –114 dBc/Hz Phase Noise at 10 kHz offset

FSEM20/30 Above features plus:

- 20 Hz to 26.5 GHz (9 kHz to 26.5 GHz FSEM20)
- –138 dBm Displayed Noise Floor (10 Hz RBW)
- –114 dBc/Hz Phase Noise at 10 kHz offset

FSEK20/30 Above features plus:

- 20 Hz to 40 GHz (9 kHz to 40 GHz FSEK20)
- –138 dBm Displayed Noise Floor (10 Hz RBW)
- –114 dBc/Hz Phase Noise at 10 kHz offset

Applications

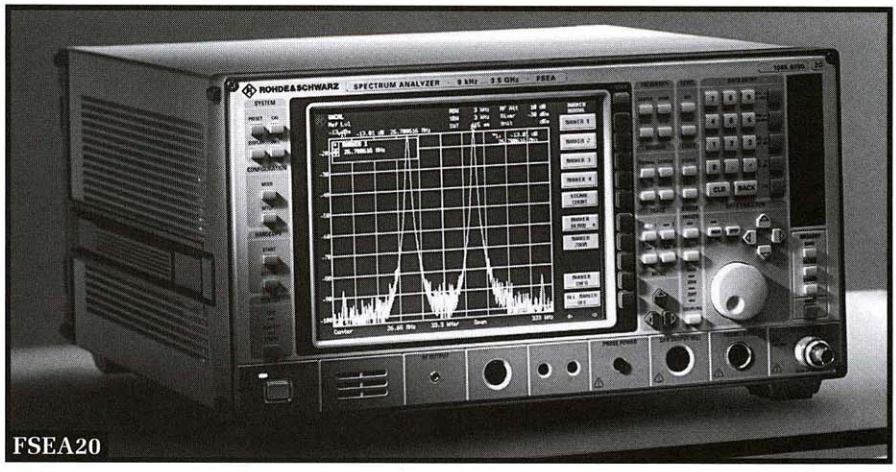
- Digital/Analog Mobile Radio Measurements
- Spread Spectrum Channel Power Measurements
- High Dynamic Range Intermodulation Measurements

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



FSEA20

FSEA20/A30, FSEB20/B30 Spectrum Analyzers

The FSE-Series spectrum analyzers have been optimized for general-purpose measurements and to meet the stringent requirements of testing advanced digital communication systems. Extremely high measurement speed, future-proof modular design, and excellent performance characteristics put these analyzers right at the top of today's market – at a medium-range price.

FSEA20/30, FSEB20/30, FSEM20/30, FSEK20/30 SPECTRUM ANALYZERS

The FSE-series spectrum analyzers have been optimized for general-purpose measurements and to meet the stringent requirements of testing advanced digital communication systems. Extremely high measurement speed, future-proof modular design, and excellent performance characteristics put these analyzers right at the top of today's market – at a medium-range price.

VECTOR ANALYSIS FOR DIGITAL MODULATION

When equipped with Option 07, the FSE-series analyzers combine the capabilities of a true RF spectrum analyzer with those of universal digital-signal demodulation and analysis. The spectrum analyzer function offers the wide dynamic range necessary for many measurements on digitally modulated signals (e.g., burst measurements). The vector signal analyzer option adds demodulation capability for:

- BPSK
- QPSK / DQPSK / π/4DQPSK / Offset QPSK
- 8PSK
- FSK (2 and 4 level)
- MSK
- GMSK
- 16QAM

Standard set-ups are included for GSM, DCS1800, DCS1900, NADC, PDC, DECT, TETRA, ERMES, CDPD, WCPE (PWT), CT2, FLEX, MODACOM, TFTS, CDMA (IS-95), and PHS

These functions are backed up by a variety of display types:

- Eye diagrams
- Vector and constellation diagrams
- Frequency and phase error
- Vector error
- Demodulated data bits

MODULARITY SAFEGUARDS INVESTMENTS

FSE-series analyzers use a modular design throughout. A wide variety of options are available to allow you to choose the exact features you need for your particular application (see the list of options in the Ordering Information for additional information).

As a result, you can tailor an instrument to your specific requirements and pay only for the performance and features you need. At the same time, you're guaranteed the capability to meet future measurement needs because most options can be retrofitted at a later time.

Spectrum Analyzers

FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

TOP DYNAMIC RANGE
FSE-series analyzers are outstanding for their extremely low noise floor without any impairment to the dynamic range at large signal levels. This can be seen, for example, from the 1-dB compression point of +10 dBm, which yields a dynamic range of 105 dB even at a resolution bandwidth of 1 MHz, allowing GSM and DECT power ramps to be determined.

The extremely wide intermodulation-free dynamic range of typically 115 dB (FSEA30, FSEB30) and 105 dB (FSEB20, FSEB30) not only ensures reliable measurements on highly linear amplifiers, it also enables detailed analysis of complex broadband signals.

UNEQUALED MEASURING CONVENIENCE
The FSE series makes measurements easy, offering a large number of convenient test functions:

- Eight markers (four absolute and four delta)
- Marker functions for direct measurement of
  – Phase noise and noise power density (/Hz)
  – NEXT MIN/PEAK, NEXT MIN/PEAK RIGHT, NEXT MIN/PEAK LEFT
- Measurement of adjacent channel power and occupied bandwidth
- Frequency counter with selectable resolution
- LOW NOISE, NORMAL, and LOW DISTORTION modes for low-intermodulation and low-noise operation
- One-button hardcopy on printer or plotter in background mode
- Simultaneous display of four active traces
- Selectable color setup – standard model 30, with Option 01 model 20
- Numerous level and frequency lines
- Split screen with independent windows
- Quasi-analog display

TO-THE-POINT FREQUENCY ACCURACY
Tuning an FSE-series spectrum analyzer is absolutely synchronous to the reference frequency for each span including full span. This means that every point on the frequency axis is determined with the accuracy of the internal reference frequency. Thus, when reducing the span for detailed signal analysis, the tiresome readjustment of the center frequency is no longer needed.

In its basic configuration, the FSE includes an AM/FM demodulator. Unknown signals can easily be identified via headphones or the built-in loudspeaker. Modulation measurements are possible using the optional Vector Signal Analyzer (Option 07).

Limit lines make it easy to check if results are within predefined tolerances. Virtual any number of limit lines can be defined with high accuracy by means of 50 points to meet even the most exacting requirements.

EASY OPERATION
FSE series analyzers feature a combination of hardkeys (fixed functions) and softkeys (menu functions). Upon pressing a hardkey, the associated menu is displayed and an input field is opened. This means very fast, hardkey-oriented handling of the main functions such as frequency (center, start, and stop), span, sweep time, reference level, etc. without the need to operate any softkey.

The full operating convenience based on a wide variety of evaluation routines and marker functions can be accessed via the menus. Complicated tree structures are a thing of the past with the FSE. Instead, the menus are lateral in structure and use fixed control keys (left, right, up).

The FSEA30, FSEB30, FSEM30, and FSEK30 are equipped with a large 9.5-inch TFT color display with VGA resolution at 640 x 480 pixels (color display available for FSEA20, FSEB20, FSEM20, FSEK20 with Option 01). All essential parameters and results can be seen at a glance. All test data, scale factors, and setting parameters are logically arranged and thus are easy to find. Setups, traces, and graticules are displayed in color to make for error-free analysis of complex results.

The USER key allows operation to be tailored to your specific requirements. With this key, you can compile the functions mainly needed for your measurement tasks, doing away with frequent menu changes and speeding up measurements on the whole by generation of macro sequences.

DOCUMENT YOUR TEST RESULTS
The FSE series provides uncomplicated logging of results. A wide variety of printers and plotters are supported. The printer/plotter interface allows printers to be addressed via the Centronics interface or via the IEC/IEEE bus. Files can also be output to a diskette or stored on the internal hard disk in PCX, WMF, or HP-GL format. This allows you to easily export waveform information to standard word processing or graphics packages.

SYSTEM MEASUREMENTS WITHOUT A COMPUTER
With the optional Computer Function (Option 15), the FSE series can operate without an external PC. Option 15 provides an additional VGA card, 16 MB memory extension, mouse, and keyboard. This option opens up the world of Windows applications such as statistics programs, spreadsheet analysis, and programming languages.

Operating software is stored on the internal hard disk. Updates can be made and functions reloaded conveniently via diskette. Complete setups, traces, limit lines, and macros can be stored on the internal hard disk or on the removable diskette.

IDEAL FOR AUTOMATIC TEST SYSTEMS
The FSE series is ideal for use in automatic test systems, providing both fast processing of results and an IEC/IEEE-bus command set conforming to SCPI. With the optional Computer Function (Option 15) and a second IEC/IEEE-bus card (Option 17), the FSE can be used as the controller for the test system, thus eliminating the need for an additional unit. This saves space in the system cabinet and saves system cost. The optional Ethernet card (Option 16 or 49) provides network connectivity.

LOW OVERALL COST OF OWNERSHIP
In designing the FSE series, special emphasis was placed on keeping cost of ownership to a minimum:

- Designed for maximum reliability
- Temperature-controlled fans
- Calibration interval up to two years
- Built-in calibration routines
- Elaborate self-test routines
- Modular design

BUILT-IN DIAGNOSTIC SYSTEM FOR SELF-TEST
The built-in self-test routines rapidly locate any faults down to the module level. In conjunction with the quick availability of replacement parts, this minimizes down time due to repair.

The self-test not only provides information on the defective module, it also enables service personnel to quickly check internal test points and make adjustments (e.g., the reference frequency) without opening the unit.

Spectrum Analyzers

FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

BUILT-IN CALIBRATION ROUTINES

Built-in calibration routines ensure that the FSE remains within defined tolerances and thus maintains its accuracy of measurement. The routines are not performed automatically by the instrument but can be started when desired by the user. This prevents on-going measurements from being inadvertently interrupted or slowed.

The results of the calibration routines are output by the FSE in the form of comprehensive correction tables. Comparing these tables over an extended period of time, the user can detect changes early and take corrective action. This enhances reliability and measurement accuracy.

MODULAR DESIGN FOR EASY UPGRADING

The modular design of the FSE allows easy installation of most options. This allows you to upgrade your instrument to meet current measurement requirements with a minimum of lost time or installation cost.

AUTOMATIC MEASUREMENT OF NOISE FIGURE AND GAIN

The FSE-K3 Noise Measurement Software, available as an optional accessory provides noise measurement capabilities for the FSE spectrum analyzers normally available in specialized noise measurement systems. In addition, the FSE Spectrum Analyzers offer a large variety of RF measurement capabilities which are not offered by the specialized systems.

The following noise parameters can be measured either at a given frequency or in a selectable frequency range:

- Noise figure in dB
- Noise temperature in K
- Gain in dB

Measurement results are output as a graph or a list. Up to eight measurements can be represented in a diagram.

Characteristics

The following characteristics apply after five minutes warm-up at ambient temperature.

Data without tolerances are typical values. Data denoted "nominal" provide functional performance information derived from the design process.

	FSEA20	FSEA30	FSEB20	FSEB30
Resolution Bandwidths				
3 dB Bandwidths (1/2/3/5 steps)	10 Hz – 10 MHz	1 Hz – 10 MHz	10 Hz – 10 MHz	1 Hz – 10 MHz
Bandwidth Error				
≤3 MHz	<10%	<10%		
5 MHz	<15%	<15%	<15%	<15%
10 MHz	+25%, –10%	+25%, –10%	+25%, –10%	+25%, –10%
Shape Factor 60/3 dB				
<1 kHz	<6	<6	<6	<6
1 kHz to 2 MHz	<15	<12	<15	<12
>2 MHz	<7	<7	<7	<7
Video Bandwidths	1 Hz to 10 MHz in 1/2/3/5 steps			

	FSEM20	FSEM30	FSEK20	FSEK30
Resolution Bandwidths				
3 dB Bandwidths	10 Hz – 10 MHz	1 Hz – 10 MHz	10 Hz – 10 MHz	1 Hz – 10 MHz
Bandwidth Error				
≤3 MHz	<10%	<10%	<10%	<10%
5 MHz	<15%	<15%	<15%	<15%
10 MHz	+25%, –10%	+25%, –10%	+25%, –10%	+25%, –10%
Shape Factor 60/3 dB				
<1 kHz	<6	<6	<6	<6
1 kHz to 2 MHz	<15	<12	<15	<12
>2 MHz	<7	<7	<7	<7
Video Bandwidths	1 Hz to 10 MHz in 1/2/3/5 steps			

Sweep Time –
Display Range 0 Hz: 1 µs to 1,000 s in 5% steps.
Display Range ≥10 Hz: 5 ms to 1,000 s in 5% steps.
Error: 1%.
Picture Refresh Rate: >20 updates/s with 1 trace, >15 updates/s with 2 traces.
Sampling Rate: 50 ns (20 MHz A/D converter).
Number of pixels: 500.
Time Measurement: With marker and cursor lines.
Resolution: 50 ns.
Sweep Trigger: Free run, single, line, video, gated, delayed, external.
Zero Span: Additionally pre-trigger, post-trigger, trigger delay.

Frequency-related	**FSEA20**	**FSEA30**	**FSEB20**	**FSEB30**	**FSEM20**	**FSEM30**	**FSEK20**	**FSEK30**
Frequency Range	9 kHz to 3.5 GHz	20 Hz to 3.5 GHz	9 kHz to 7 GHz	20 Hz to 7 GHz	9 kHz to 26.5 GHz	20 Hz to 26.5 GHz	9 kHz to 40 GHz	20 Hz to 40 GHz
Frequency Resolution	0.01 Hz							
Frequency Axis	Linear or logarithmic							
Reference Frequency Internal (nominal)								
Aging, after 30 days operation	1×10^{-6}/year	1×10^{-9}/day 2×10^{-7}/year	1×10^{-6}/year	1×10^{-9}/day 2×10^{-7}/year	1×10^{-6}/year	1×10^{-9} /day 2×10^{-7} /year	1×10^{-6}/year 2×10^{-7} /year	1×10^{-9} /day
Temperature drift (0 to 50° C)	1×10^{-6}	5×10^{-8}	1×10^{-6}	5×10^{-8}	1×10^{-6}	5×10^{-8}	1×10^{-6}	5×10^{-8}
Total error	2.5×10^{-6}/year	2.5×10^{-7}/year	2.5×10^{-6}/year	2.5×10^{-7}/year	2.5×10^{-6}/year	2.5×10^{-7}/year	2.5×10^{-6}/year	2.5×10^{-7}/year
With Option 04								
Aging, after 30 days operation	1×10^{-9}/day	–	1×10^{-9}/day	–	1×10^{-9}/day	-	1×10^{-9}/day	–
	2×10^{-7}/year		2×10^{-7}/year			2×10^{-7}/year		2×10^{-7}/year
Temperature drift (0 to 50° C)	5×10^{-8}	–	5×10^{-8}	–	5×10^{-8}	–	5×10^{-8}	–
Total error	2.5×10^{-7}/year	–	2.5×10^{-7}/year	–	2.5×10^{-7}/year	–	2.5×10^{-7}/year	–
External	10 MHz or n x 1 MHz (where n = 1 to 16)							
Frequency Display (with marker)								
Resolution	0.1 Hz to 10 kHz (dependent on span)							
Error	±(marker frequency x reference error + 0.5% span + 10% x resolution bandwidth + 10 Hz + 1/2 (last digit)							
Frequency Counter (measures marker frequency)								
Resolution	0.1 Hz to 10 kHz (selectable)							
Count accuracy (S/N >25 dB)	±(frequency x reference error + 10 Hz + 1/2 (last digit)							
Display Range for Frequency Axis (0 Hz, 10 Hz to full span)								
Resolution	0.1 Hz							
Error of Display Range	1%							
Spectral Purity (SSB phase noise, RF frequency ≤500 MHz, carrier offset) – See FSE data sheet for Spectral Purity f ≥ 500 MHz								
Standard								
100 Hz	–	<–87 dBc/Hz	–	<–81 dBc/Hz	–	<–81 dBc/Hz	–	<–81 dBc/Hz
1 kHz	<–85 dBc/ Hz	<–107 dBc/Hz	<–79 dBc/Hz	<–100 dBc/Hz	<–79 dBc/Hz	–100 dBc/Hz <–79 dBc/Hz	–100 dBc/Hz	
10 kHz	<–96 dBc/Hz	<–120 dBc/Hz	<–90 dBc/Hz	<–114 dBc/Hz	<–90 dBc/Hz	<–114 dBc/Hz	<–90 dBc/Hz	<–114 dBc/Hz
100 kHz[1]	<–119 dBc/Hz	<–117 dBc/Hz	<–113 dBc/Hz	<–111 dBc/Hz	<–113 dBc/Hz	<–111 dBc/Hz	<–113 dBc/Hz	<–111 dBc/Hz
1 MHz [1]	<–135 dBc/Hz	<–135 dBc/Hz	–129 dBc/Hz	–129 dBc/Hz	<–129 dBc/Hz	<–129 dBc/Hz	<–129 dBc/Hz	<–129 dBc/Hz
With Option 04 Models 20 with Option 04 same as Models 30.								

[1]Valid for span >100 kHz.

Spectrum Analyzers

FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

LEVEL-RELATED

Display Range – Noise floor displayed to 30 dBm.

Maximum Input Level –

RF Attenuation 0 dB:
DC voltage: 0 V.
CW RF power: 20 dBm (= 0.1 W).
Pulse spectral density: 97 dBµV/MHz.
RF attenuation ≥10 dB:
DC voltage: 0 V.
CW RF power: 30 dBm (= 1 W).

Maximum pulse voltage:
FSEA20/FSEA30/,FSEB20/FSEB30: 150 V.
FSEM20/FSEM30: 50 V.
FSEK20/FSEK30: 50 V.

Maximum pulse energy (10 µs):
FSEA20/FSEA30/,FSEB20/FSEB30: 1 mWs.
FSEM20/FSEM30: 0.5 mWs.
FSEK20/FSEK30: 0.5 mWs.

1-dB Compression of Input Mixer (0 dB RF attenuation): +10 dBm.

	FSEA20	FSEA30	FSEB20	FSEB30
Displayed Averaged Noise Floor (RBW = 10 Hz, 0 dB RF attenuation, VBW = 1 Hz, 20 averages, trace average, span 0 Hz, 50 Ω termination)				
Frequency				
20 Hz		–<–80 dBm		<–74 dBm
1 kHz		–<–110 dBm		<–104 dBm
10 kHz	<–90 dBm	<–125 dBm	<–84 dBm	<–119 dBm
100 kHz	<–110 dBm	<–135 dBm	<–104 dBm	<–129 dBm
1 MHz	<–130 dBm, –135 dBm typ.	<–145 dBm, –150 dBm typ.	<–125 dBm, –130 dBm typ.	<–142 dBm, –145 dBm typ.
10 MHz to 3.5/6 GHz	<–145 dBm, –150 dBm typ.	<–145 dBm, –150 dBm typ.	<–142 dBm, –147 dBm typ.	<–142 dBm, –147 dBm typ.
6 to 7 GHz			<–139 dBm	<–139 dBm
7 to 18 GHz				
18 to 26.5 GHz				
26.5 to 30 GHz				
30 to 40 GHz				
Maximum Dynamic Range	10 Hz BW	1 Hz BW	10 Hz BW	1 Hz BW
Displayed Noise Floor (at 1-dB compression)	155 dB	165 dB	152 dB	162 dB
Maximum Harmonics Suppression, (f >50 MHz)	>90 dB			

	FSEM20	FSEM30	FSEK20	FSEK30
Displayed Averaged Noise Floor (RBW = 10 Hz, 0 dB RF attenuation, VBW = 1 Hz, 20 averages, trace average, span 0 Hz, 50 Ω termination)				
Frequency				
20 Hz	–	<–74 dBm	–	<–74 dBm
1 kHz	–	<–104 dBm	–	<–104 dBm
10 kHz	–84 dBm	<–119 dBm	<–84 dBm	<–119 dBm
100 kHz	–104 dBm	<–129 dBm	<–104 dBm	<–129 dBm
1 MHz	<–124 dBm, –129 dBm typ.	<–142 dBm –145 dBm typ.	<–124 dBm, –129 dBm typ.	<–142 dBm, –145 dBm typ.
10 MHz to 3.5/6 GHz	<–138 dBm, –140 dBm typ.	<–138 dBm, <–140 dBm typ.	<–138 dBm, –140 dBm typ.	<–138 dBm, –140 dBm typ.
6 to 7 GHz	<–135 dBm, <–138 dBm typ.	<–135 dBm, <–138 dBm typ.	<–134 dBm, –139 dBm typ.	<–134 dBm, –139 dBm typ.
7 to 18 GHz	<–138 dBm, <–140 dBm typ.	<–138 dBm, <–140 dBm typ.	<–134 dBm, –139 dBm typ.	<–134 dBm, –139 dBm typ.
18 to 26.5 GHz	<–135 dBm, –138 dBm typ.	<–135 dBm, –138 dBm typ.	<–131 dBm, –136 dBm typ.	<–131 dBm, –136 dBm typ.
26.5 to 30 GHz			<–120 dBm, –125 dBm typ.	<–120 dBm, –125 dBm typ.
30 to 40 GHz			<–116 dBm, –122 dBm typ.	<–116 dBm, –122 dBm typ.
Maximum Dynamic Range	10 Hz BW	1 Hz BW	10 Hz BW	1 Hz BW
Displayed Noise Floor (at 1–dB compression)	150 dB	160 dB	150 dB	160 dB
Maximum Harmonics Suppression, (f >50 MHz)	>90 dB			

Spectrum Analyzers

FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

Level Display –

Screen: 10 x 10 subdivisions.
Trace: 500 x 400 pixels (with one diagram displayed)
Log Level Axis: 10 to 200 dB (10 dB steps).
Linear Level Axis: 10% of reference level per level division, 10 divisions.

Setting Range of Reference Level –

Log Level Display: –130 to 30 dBm (0.1 dB steps).
Linear Level Display: 7.0 nV to 7.07 V (1% steps).

Units of Level Axis:
Log level display: dBm, dBµV, dBµA, dBpW
Linear level display: mV, µV, mA, µA, pW, nW

Level Measurement Error –

(10 Hz to 30 kHz and 100 kHz to 10 MHz, –40 dBm, 20 dB RF Atten, reference level –15 dB, RBW 5 kHz) –
Absolute Error at 120 MHz: <0.3 dB.

Frequency Response (10 dB RF Atten):
<1 GHz <0.5 dB.
1 to 3,5/7 GHz <1 dB.
7 to 18 GHz (FSEM20/30, FSEK20/30): <2 dB.18 to 26.5 GHz (FSEM20/30, FSEK20/30): <2.5 dB. 26.5 to 40 GHz (FSEK20/30): <3.0 dB.

Attenuator Error: <0.3 dB.
FSEM20/FSEM30: <0.4 dB + 1.3% of attenuation.
IF Gain Error: <0.2 dB, 0.1 dB typical

Linearity Error:
Log level display:
RBW ≥1 kHz, analog, S/N >15 dB):
0 to –50 dB: <0.3 dB
–50 to –70 dB: <0.5 dB
–70 to –80 dB
(FSEA20/FSEB20/FSEK20/FSEM20): <1 dB.
–70 to –95 dB
(FSEA30/FSEB30/FSEK30/FSEM30): <1 dB.
RBW ≤1 kHz, digital, S/N >15 dB:
0 to –100 dB: <0.3 dB nominal.
RBW ≤100 kHz, digital, S/N >15 dB:
0 to –50 dB: <0.5 dB nominal.
Linear level display: 5% of reference level.

Bandwidth Switching Error:
1 Hz to 30 kHz, 100 to 300 kHz: <0.2 dB.
1 to 10 MHz: <0.3 dB.

	FSEA20	FSEA30	FSEB20	FSEB30
Maximum Intermodulation-free Range				
50 MHz to 3.5 / 7 GHz	105 dB	115 dB	–	–
150 MHz to 7/26.5 GHz (nom)	–	–	105 dB	115 dB
Intermodulation				
3rd-order intercept point (TOI) (Δf >5 x resolution BW or >10 kHz)	FSEA20/FSEA30: ≥12 dBm, 15 dBm typical for f >50 MHz FSEB20/FSEB30: ≥12 dBm, 15 dBm typical for f >150 MHz			
Intermodulation-free range at –40 dBm mixer levels: 105 dB.				
Intercept point k2				
FSEA20/FSEA30: >25 dBm, >40 dBm typical for f <50 MHz; >45 dBm, >50 dBm typical for f >50 MHz. FSEB20/FSEB30: >25 dBm for f <150 MHz, >35 dBm typical; >40 dBm for f >150 MHz, >45 dBm typical.				
Immunity to Interference				
Image frequency	>75 dB	>80 dB, >90 dB typ.	>80 dB, >75 dB typ.	>80 dB, >75 dB typ.
Intermediate frequency	>70 dB	>100 dB	>75 dB	>75 dB
Spurious response (f >1 MHz, without input signal, 0 dB attenuation)				
Span <30 MHz	<–100 dBm	<–110 dBm	<–100 dBm	<–100 dBm
Span ≥30 MHz	<–100 dBm	<–110 dBm	<–100 dBm	<–100 dBm
fin = 25.175 MHz	<–100 dBm	<–110 dBm	<–100 dBm	<–100 dBm
fin = 60 MHz	<–100 dBm	<–110 dBm	<–100 dBm	<–100 dBm
fin = 5717.2 MHz	–	–	–	<–100 dBm

	FSEM20	FSEM30	FSEK20	FSEK30
Maximum Intermodulation-free Range				
50 MHz to 3.5 / 7 GHz	–	–	–	–
150 MHz to 7/26.5 GHz (nom)	103 dB	112 dB	103 dB	112 dB
Intermodulation				
3rd-order intercept point (TOI) (Δf >5 x resolution BW or >10 kHz)	≥12 dBm, 15 dBm typical for f >150 MHz			
Intermodulation-free range at –40 dBm mixer levels: 105 dB.				
Intercept point k2				
>25 dBm for f <150 MHz, >35 dBm typical; >40 dBm for f >150 MHz, >45 dBm typical.				
Immunity to Interference				
Image frequency	>80 dB, >90 dB typ.	>80 dB, >90 dB typ.	>80 dB, >90 dB typ.	>80 dB, >90 dB typ.
Intermediate frequency	>70 dB	>70 dB	>80 dB	>80 dB
Spurious response (f >1 MHz, without input signal, 0 dB attenuation)				
Span <30 MHz	<–110 dBm	<–100 dBm	<–110 dBm	<–100 dBm
Span ≥30 MHz	<–110 dBm	<–100 dBm	<–110 dBm	<–100 dBm
fin = 25.175 MHz	<–110 dBm	<–100 dBm	<–110 dBm	<–100 dBm
fin = 60 MHz	<–110 dBm	<–100 dBm	<–110 dBm	<–100 dBm
fin = 5717.2 MHz	–	<–100 dBm	–	<–100 dBm

Total Measurement Error (0 to –50 dB) –
<1 GHz <1 dB.
>1 GHz <1.5 dB.
7 to 18 GHz
FSEM20/30): <2 dB.
FSEK20/30): <2.5 dB.
18 to 26.5 GHz
FSEM20/30: <2.5 dB.
FSEK20/30: <3.0 dB.
26.5 to 40 GHz (FSEK20/30): <3.5 dB.

Pulse Amplitude Error (single pulses) –
Bandwidth <1 MHz: <0.5 dB nominal.
Bandwidth ≥1 MHz: 2 dB nominal.

Spectrum Analyzers

FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

DISPLAY-RELATED –

	FSEA20	FSEA30	FSEB20	FSEB30	FSEM20	FSEM30	FSEK20	FSEK30
Standard	24-cm (9.5-inch) LC display	24-cm (9.5-inch) LC color display	24-cm (9.5-inch) LC display	24-cm (9.5-inch) LC color display	24-cm (9.5-inch) LC display	24-cm (9.5-inch) LC color display	24-cm (9.5-inch) LC display	24-cm (9.5-inch) LC color display
With Option 01	24-cm (9.5-inch) LC color display	-	24-cm (9.5-inch) LC color display	-	24-cm (9.5-inch) LC color display	-	24-cm (9.5-inch) LC color display	-
Resolution	640 x 480 pixels (VGA resolution)							

TRIGGER-RELATED

Trigger Source – Free run, Line, Video, RF, External.

Delayed Sweep –
Trigger Source: Free run, Line, Video, RF, External.
Delay Time: 100 ns to 10 s.
Resolution (minimum): 1 µs (or 1% of delay time).
Delay Time Error: ±(1 µs + (0.1% x delay time)).
Delayed Sweep Time: 2 µs to 1,000 s.

Gated Sweep –
Trigger Source: External, RF.
Gate Delay: 1 µs to 100 s.
Gate Length: 1 µs to 100 s.
Resolution (minimum): 1 µs or 1%
Gate Length Error: ±(1 µs + (0.05% x gate length)).

Gap Sweep (Span = 0 Hz) –
Trigger Source: Free run, Line, Video, RF, External.
Pretrigger: 1 µs to 100 s
Trigger-to-Gap Time: 1 µs to 100 s.
Gap Length: 1 µs to 100 s.
Gap Resolution: 500 ns (dependent on sweep time).

DEMODULATION-RELATED

Modulation Modes – AM and FM

Audio Output – Loudspeaker and headphones.

Marker Stop Time – 100 ms to 60 s.

Squelch – Adjustable by means of level line.

INPUTS AND OUTPUTS

RF Input (front-panel) –
FSEA20/30, FSEB20/30: N female, 50 Ω.
FSEM20/30: Adapter system, 50 Ω, N male and female, 3.5 mm male and female.
FSEK20/30: Adapter system, 50 Ω N male and female, K male and female.

VSWR (RF attenuation >0 dB):
f <3.5 GHz <1.5:1 (FSEK20/30 <1.6:1).
f <7 GHz (FSEB20/30, FSEM20/30, FSEK20/30): <2.0:1.
f <26.5 GHz (FSEM20/30): <3 (FSEK20/30 ≤2.5:1).
f <40 GHz (FSEK20/30): 2.5:1.
Attenuator: 0 to 70 db, selectable in 10-dB steps.

Probe Power Supply (front-panel) –
Output: +15 V DC, –12.6 V DC, and ground, maximum 150 mA.

Power Supply and Coding Connector for Antennas, Etc. (front-panel) –
Connector: 12-contact Tuchel.
Supply voltages: ±10 V @ 100 mA maximum, ground.

AF Output (front-panel) – Z_{out}: 10 Ω
Connector: jack plug.
Open-Circuit Voltage: Adjustable up to 1.5 V.

IF 21.4 MHz (rear panel) – Zout: 50 Ω.
Connector: BNC female.
Bandwidth: >1 kHz or resolution bandwidth.
Level: 0 dBm at reference level, mixer level >–60 dBm.

Video Output (rear panel) – Zout: 50 Ω.
Connector: BNC female.
Voltage (BW ≥1 kHz): 0 to 1 V, full scale (open-circuit voltage), log scaling.

Reference Frequency (rear panel) –
Output (usable as input):
Connector: BNC female.
Frequency: 10 MHz.
Level: 10 dBm nominal.

Input:
Frequency:1 to 16 MHz, integer MHz
Required level: >0 dBm from 50 Ω source.

Sweep Output (rear panel) –
Connector: BNC female.
Signal: 0 to 10 V, proportional to displayed frequency.

Noise Source (rear panel) –
Function: Power supply connector for noise source.
Connector: BNC female.
Voltage Output: 0 and 28 V, switch-selected.

External Trigger/Gate Input (rear panel) –
Connector: BNC female.
Impedance: >10 kΩ
Voltage: TTL level

GPIB Interface (rear panel) –
Connector: 24-contact Amphenol female.
Standard: IEC-625-2 (IEEE 488.2).
Instruction Set: SCPI 1994.0.
Interface Functions: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C11.

Serial Interface (rear panel COM 1 and COM 2) –
Connector: 9-contact female.
Standard: RS-232C.

Plotter –
Interface: Via IEC / IEEE bus or RS-232C
Plotter Language: HP-GL.

Mouse Interface (rear panel) –
PS / 2 compatible.

Printer Interface (rear panel) –
Parallel (Centronics compatible) or serial (RS-232C).

Keyboard (rear panel) –
Connector: 5-contact DIN female for MF-2 keyboard.

User Interface (rear panel) –
25-contact Cannon female.

External Monitor (rear panel) –
Connector:15-contact female.

VECTOR SIGNAL ANALYSIS (OPT. 07)

Digital Modulated Signals –
Signal Types: Continuous and TDMA.
Modulation Formats: BPSK, QPSK, Offset-QPSK, DQPSK, π/4-DQPSK, 8PSK, D8PSK, 16QAM, MSK/GMSK, 2(G)FSK, 4(G)FSK.
Standards: GSM/DCS1800/PCS1900, NADC, TETRA, PDC, PHS, CDPD, DECT, WCPE, CT2, ERMES, FLEX, MODACOM, TFTS, QCDMA (IS95).

Filtering:
Filter Types: Raised cosine, square root raised cosine, gaussian.
Range a/BT: 0.2 to 3.

Spectrum Analyzers
FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

Types of Standard Specific Filters: Bessel B * T = 1.22 and 2.44 (FLEX Standard), Bessel B * T = 1.25 (ERMES Standard), QCDMA Forward Channel, QCDMA Reverse Channel (IS95).
Numerical Readout: Error vector magnitude 1, Magnitude 1, Phase 1, Frequency, I/Q offset, I/Q imbalance, Amplitude droop, r-Faktor.

FSK –
Measurements with FSK:
Frequency demodulated signal (filtered, synchronized to symbol clock).
FSK reference signal (calculated from demodulated bits).

FSK error signal.
Bit stream/modulation error (detected symbols at ideal decision points and table of all modulation errors).

Display Types with FSK:
Time Domain: Magnitude, frequency deviation, eye diagram (frequency signal).

Error Display in Time Domain: Deviation error, magnitude error.

Numerical Readout: Deviation error 1, magnitude error 1, FSK deviation, frequency error, FSK reference deviation.

Modulation Measurement Range –
Symbol Rate: 320 Hz to 2 MHz.

Points per symbol[2]:
Symbol rate ≤200 kHz: 1, 2, 4, 8, 16.
Symbol rate >200 kHz ≤400 kHz: 1, 2, 4, 8.
Symbol rate >400 kHz: 1, 2, 4.

Size of Capture Memory:
Symbol rate ≤1 MHz:
16,000 samples maximum.
Symbol Rate >1 MHz:
3,200 samples maximum.

Number of Demodulated Symbols:
Symbol Rate ≤1 MHz:
4 samples per symbol:
1,600 symbols maximum.
8 samples per symbol:
800 symbols maximum.
16 samples per symbol:
400 symbols maximum.
Symbol Rate >1 MHz:
600 symbols maximum.

Level Measurement –
Measurement Range:
Peak power –60: +30 dBm.
Dynamic range for burst measurements (mean power, Ref level ≥–10 dBm, peak power = Ref Level +1 dB, low noise mode, points per symbol ≤4): 80 dBc –4 * log (symbol rate/kHz).

Absolute Level Measurement Error (average power 0 to –10 dB below ref level):
f≤1 GHz 1 dB.
f>1 GHz See total measurement error specified for specific models.

Relative Level Measurement Error:
Average power level 0 to –10 dB below ref level: 0.2 dB.
Average power level –10 to –50 dB below ref level: (0.0325/dB – 0.125) dB

Time Reference (nominal, without clock synchronization):
With MSK/GMSK modulation: <1/(2 * symbol rate * points per symbol).
With PSK/QAM/FSK modulation: <1/(2 * symbol rate).
With clock synchronization: <0.001 * 1/(symbol rate).

Residual Error in Modulation Measurements (level in range, ref. level to ref. level -6 dB, S/N >60 dB, (a/B * T = 0.3 to 0.7, number of demodulated symbols >100, averaging ≥10, analog bandwidth >10 * symbol rate):

Input Frequency:
Models 20, ≥20 MHz.
Models 30, >15 * (symbol rate), local suppression calibrated.

General Modulation Modes (except FSK3) –
Vector Error Magnitude (EVM) (symbol rate 300 kHz to <2 MHz): 2% (RMS).
Magnitude Error (symbol rate 300 kHz to <2 MHz): 2% (RMS).
Phase Error (with modulation formats using constant signal amplitude), symbol rate 300 kHz to <2 MHz: 1.5° (RMS).
Frequency Error: Symbol rate * 5x10-6 ± 0.1 Hz + error of reference frequency.
At Modulation Standard:

Modulation Standard	Vector Error Magnitude	Phase Error	RHO–Factor
GSM (DCS 1800/ PCS1900)	–	≤0.5° RMS ≤1.5° PEAK (typ.)	–
NADC, CDPD	≤0.5% RMS ≤1.5% PEAK (typ.)	–	–
TETRA, PDC	≤0.7% RMS ≤2% PEAK (typ.)	–	–
PHS	≤0.7% RMS ≤2% PEAK (typ.)	–	–
WCPE	≤1% RMS ≤3% PEAK (typ.)	–	–
QCDMA, Fwd. CH QCDMA, Rev. CH	–	–	≥0.9995

General FSK Modulation Modes 3 (input level ≥–10 dBm, Low Noise Mode) –

Symbol Rate	< 300 kHz	300kHz to 2 MHz
Deviation Error 4	1.5% RMS	2% RMS
FSK Deviation	Within 1.5% of nominal	Within 2% of nominal
Magnitude Error	1% RMS	2% RMS
Frequency Offset	0.5% of reference deviation + error of reference frequency	0.5 % of reference deviation + error of reference frequency

At Modulation Standard (input level ≥–10 dBm, Low Noise Mode, all standards except ERMES and FLEX) at 4 points per symbol. ERMES and FLEX at 16 points per symbol):

Standard	Deviation error
DECT	≤2% RMS, <6% PK typ.
MODACOM, CT2	≤1.5% RMS, <3% PK typ.
ERMES, FLEX	≤2% RMS, <6% PK typ.

Measurement Time (readout of detected symbols and numerical modulation errors, synchronized):

GSM, DCS1800, PCS1900: 330 ms.
NADC, TETRA, TFTS, WCPE. PDC, PHS, CDPD, DECT, ERMES, FLEX, MODACOM: 800 ms.

NOISE MEASUREMENT (WITH FSE-K3 SOFTWARE)
Frequency Range – 100 kHz to 26.5 GHz (dependent on spectrum analyzer.

Measurement Bandwidth – 1 kHz to 5 MHz.

Noise Measurements –
Level Range: 0 to 25 dB.
Resolution: 0.1 dB.
Measurement Accuracy (preamplification 20 dB, noise figure, 5 dB, bandwidth 1 MHz): ±0.2 dB.

*[*1] RMS and PEAK values.*

*[*2]Four samples per symbol is the minimum value. At setting 1 or 2 points per symbol, only 1 or 2 points per symbol of the four samples per symbol are shown.*

*[*3] FSEA30 or FSEA20 with Option 4 (FSE-B4) – Data valid for RF <1 GHz.*
For RF ≥1 GHz multiply stated values by a factor of:
$$_{10}0.552 * \log \frac{f\ (GHz)}{1\ (GHz)}$$
FSEB30 and FSEM30, or FSEB20 and FSEM20 with Option 4 (FSE-B4) –
For RF <1 GHz multiply data by 1.4.
For RF ≥1 GHz multiply data by 1.4 plus a factor of:
$$_{10}0.354 * \log \frac{f\ (GHz)}{1\ (GHz)}$$
FSEA20, FSEB20, FSEM20 without Option 4 (FSE–B4) – Typically worse by a factor of 3 compared to FSEA30/FSEB30/FSEM30 or FSEA20/FSEB20 /FSEM20 with Option 4 (FSE-B4).

*[*4]+2 * 10-4 * fsymb * (points-per-symbol) [Hz].*

Spectrum Analyzers

FSEA20/30 • FSEB20/30 • New FSEM20/30 • New FSEK20/30

Required Equipment –
Spectrum Analyzer: FSEA, FSEB, FSEM, or FSEK.
Preamplifier: Gain approximately 20 dB, maximum noise figure 5 dB.
Stand-alone Operation: FSE Spectrum Analyzer equipped with Opt. 15.
Controller Operation (not required with Opt. 15): 80486 IBM PC or compatible with Windows 3.1 or better and a GPIB interface card.

GENERAL

Mass Memory – Built-in 1.44 MB 3.5-inch diskette, hard disk.

Calibration Interval – 1 year (2 years for operation with external reference).

ENVIRONMENTAL CHARACTERISTICS

Temperature Range –
Nominal Operating Range: +5 to +40° C.
Limit Operating Range: 0 to +50° C.
Storage: –40° to +70° C.

Climactic Loading – +40° C at 95% relative humidity (IEC 68-2-3).

Mechanical Stress –
Sinusoidal Vibration: 5 to 150 Hz, maximum 2 g at 55 Hz; 0.5 g from 55 to 150 Hz; to IEC 68-2-6, IEC 68-2-3, IEC 1010-1, MIL-T-28800D, class 5.
Random Vibration: 10 to 300 Hz, acceleration 1.2 grms.
Shock: 40 g shock spectrum, to MIL-STD 810C and MIL-T-28800D, classes 3 and 5.

RFI Suppression – To EMC directive of EU (89 / 336 / EEC) and German EMC law.

Safety – To EN 61010-1

POWER REQUIREMENTS

AC Supply (class of protection 1 to VDE 411) –
Line Voltage: 100 / 120 / 230 / 240 V ±10%.
Frequency: 47 to 440 Hz

Power Consumption:

FSEA20: 170 VA.	FSEM20: 220 VA.
FSEA30: 180 VA.	FSEM30: 230 VA.
FSEB20: 185 VA.	FSEK20: 220 VA.
FSEB30: 195 VA.	FSEK30: 230 VA.

PHYSICAL

Dimensions	mm	in.
Width	435	17.1
Height	236	9.3
Depth (FSEA,FSEB FSEM20)	460	18.4
Depth (FSEM30, FSEK)	570	22.5
Weight	**kg**	**lb.**
FSEA20	21.5	47.3
FSEA30	22.7	49.9
FSEB20	21.8	48.0
FSEB30	23	50.6
FSEM20	23.8	52.4
FSEM30	25.2	55.4
FSEK20	24.4	53.7
FSEK30	25.8	56.8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

FSEA20
9 kHz to 3.5 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses.

FSEA30
20 Hz to 3.5 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses.

FSEB20
9 kHz to 7 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses.

FSEB30
20 Hz to 7 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses.

FSEM20
9 kHz to 26.5 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses, Adapter 3.5-mm Female and N Female.

FSEM30
20 Hz to 26.5 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses, Adapter 3.5-mm Female and N Female.

FSEK20
9 kHz to 40 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses, Test-port Adapter K-female, N-female.

FSEK30
20 Hz to 40 GHz Spectrum Analyzer
Includes: Power Cable, Operating Manual, Spare Fuses, Test-port Adapter K-female, N-female.

OPTIONS

Opt. 01/FSE-B1 – FSEA20, FSEB20, FSEK20, FSEM20 Color display (standard on FSEA30, FSEB30, FSEK30, FSEM30).

Opt. 02/FSE-B2 – FSEA20, FSEA30 7-frequency extension.

Opt. 04/FSE-B4 – FSEA20, FSEB20, FSEK20, FSEM20 Low phase noise and OCXO (standard on FSEA30, FSEB30, FSEK30, FSEM30).

Opt. 07/FSE-B7 – Vector signal analyzer.

Opt. 15/FSE-B15 – Computer function (English).

Opt. 16/FSE-B16 – Ethernet interface (AUI).

Opt. 17/FSE-B17 – Second IEC/IEEE-bus interface (enables Opt. 15 to control FSEA/FSEB plus external instruments.

Opt. 49/FSE-B16 – Ethernet interface (BNC)

MEASUREMENT SERVICE OPTIONS (FSEA20/30, FSEB20/30, FSEM20/30, FSEK 20/30)

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES

Noise Figure Measurement Software – Order FSE-K3.

Service Kit – Extender boards and Coaxial Cables. Order FSE-Z1.

Keyboard – American. Order PSA-Z1.

GPIB Cable – 0.5m. Order 012-1282-00.

GPIB Cable – 1 m. Order 012-0991-01.

GPIB Cable – 2 m. Order 012-0991-00.

GPIB Cable – 4 m. Order 012-0991-02.

19-inch Rack Adapter – With front handles. Order ZZA-95.

19-inch Rack Adapter – Without front handles. Order ZZA-951.

Set of Front Handles – Order ZZG-95.

Transit Case – Order ZZK-954. (FSEA, FSEB, FSEM20, FSEK20).
Order ZZK-955 (FSEM30, FSEK30).

Trolley – Order ZZK-1

Matching Pad – 75 Ω, L Section. Order RAM.

Matching Pad – 25 Ω, Series Resistor. Order RAZ.

Preamplifier – 9 kHz to 30 MHz. Order ESH3-Z3.

Preamplifier – 20 Hz to 1 GHz. Order ESV-Z3.

See Tektronix on the World Wide Web: http://www.tek.com

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Spectrum Analyzers
R3271A • R3371A • R3265A • R3365A

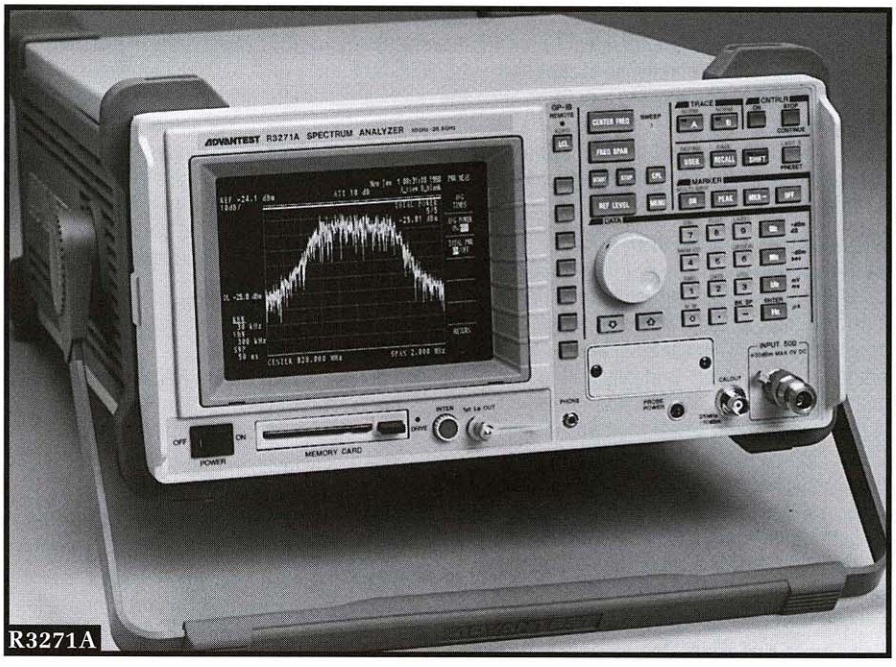
Features

R3271A/R3371A, R3265A/R3365A

- Excellent Spectral Purity: –110dBc/Hz (10 kHz Away from Carrier)
- Resolution Bandwidth of 10 Hz to 3 MHz
- Built-in Frequency Counter with 1 Hz Resolution
- Audio Demodulation with Internal Speaker
- Portable System with a Large CRT Display
- High-speed 5 µs/div Sweep
- TDMA Signal Analysis
- Memory Card Function
- Multi-marker with up to Eight Points
- Extensive Built-in EMC Measurement Functions
- Conforms to MIL-T-28800 Standards
- Built-in Tracking Generator (R3365A and R3371A)

Applications

- Digital Mobile Radio Test
- Antenna and Base Station Test
- Radio Communications System Test
- Microwave Device Test



R3271A

R3271A/R3371A Spectrum Analyzer

The R3271A/R3371A spectrum analyzer is designed to analyze pulse RF signals used for radar or to analyze the spectra of microwaves and quasi-millimeter waves used for satellite broadcasting, satellite communications, and mobile communication.

The R3271A/R3371A can measure the ultra-wide frequency range of 100 Hz to 26.5 GHz in one sweep operation. It can also perform the sweep continuously and repeatedly. A newly developed high-purity synthesizer enables a high signal purity of –110 dBc/Hz at 2.6 GHz and –108 dBc/Hz at 7.5 GHz (10 kHz offset).

The R3271A/R3371A spectrum analyzer is thus ideally suited for mobile radio communication, for which narrower signal bandwidths and digital transmission are being implemented. In the past, such high-performance equipment was used only for advanced research and development; however, this level of performance is now needed on a commercial level.

R3265A/R3365A Spectrum Analyzer

The R3265A/R3365A is a quasi-microwave spectrum analyzer designed to meet user needs and to ensure easy operations. The R3265A/R3365A incorporates a time domain function so it can be used for both digital and analog mobile communication. The R3265A/R3365A can measure a wide frequency range of 100 Hz to 8 GHz in one sweep over a wide dynamic range. Even at a frequency of 2.6 Hz, a newly developed high-purity synthesizer enables a high signal purity of –110 dBc/Hz (offset frequency of 10 kHz).

This unit performs especially well in measuring the spurious emission intensity of mobile communications equipment, occupied bandwidth, and signal leakage from adjacent channels. In the low-noise mode, the R3265A/R3365A has a high-input sensitivity of –145 dBm (1 MHz to 3.6 GHz), so it can easily measure faint signals.

In addition to its popular user-defined functions, the R3265A/R3365A incorporates a multi-marker function, as well as a function to list the frequency and level displayed by the multi-marker. A memory card function can save or recall measurement settings, measurement data, and user definitions. Using this function, the time needed for measurement and panel resetting operations can be significantly shortened.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Spectrum Analyzers
R3271A • R3371A • R3265A • R3365A

TRACKING GENERATOR
The R3365A and R3371A are identical to the R3265A and R3271A respectively, except that the R3365A and R3371A include a built-in tracking generator to facilitate frequency response measurements and provide scalar network analyzer capability (with an external SWR bridge).

BURST SIGNAL ANALYSIS FUNCTIONS
- **Fast Digitized Sweep.** The R3265A/R3365A, R3271A/R3371A use a high-speed digitizer to perform high-speed sweeps of 5 µs/div during zero span. This data can also be averaged. This function is ideally suited for monitoring the mean transmission power and duration of Time Division Multi-Access (TDMA) signals that are used in the Global System for Mobile Communication (GSM) systems in Europe and in the next-generation mobile telephone systems in Japan and the U.S.A. (e.g., digital mobile telephones). An arbitrary range can be expanded using the delayed sweep function.
- **Gated Sweep Function.** The burst signal (TDMA and video signals) analysis function, when combined with the high-speed sweep, can be used to monitor the transmission power in an arbitrary one-time slot of a TDMA signal or to analyze the noise in one horizontal line of a TV signal. Until now, the gated sweep function required an external gated sweep signal. The R3265A/R3271A standard configuration permits analysis of the spectrum of a burst signal without the need for an external gate or trigger signal.
- **Delayed Sweep.** Delayed sweep can be used to zoom in on detail in the time domain. The user can set a delay time following an internal or external trigger event.

MEASUREMENT OF OCCUPIED FREQUENCY BANDWIDTHS AND ADJACENT-CHANNEL LEAKAGE POWER
By calculating from the measured spectrum data, the occupied frequency bandwidth of a radio transmission characteristic and the leakage power of an adjacent channel can be easily measured. The carrier frequency is also displayed when the occupied frequency bandwidth is measured. The leakage from an adjacent channel can be measured in a dynamic range of 70 dB (typical value) with high signal purity.

INTERNAL TRACKING GENERATOR
The R3365A and R3371A include an internal tracking generator to dynamically measure the resonant characteristic of a high-Q element or the frequency response of a dielectric filter. In addition, the 120 dB dynamic-range display guarantees a 110 dB dynamic measurement range for frequency response measurement with the tracking generator. Therefore, even high stop-band attenuation can be measured.

OPTICAL MODULATION SPECTRUM ANALYZER
Addition of the Q32605 Optical Receiver plug-in allows the R3265A/R3271A to function as an optical modulation spectrum analyzer.

Optical input sensitivity with the Q32605 is –160 dBm/Hz, frequency range of 6 MHz to 2.4 GHz, and a frequency flatness of ±1.8 dB.

The R3265A/R3271A/Q32605 can be used to measure RIN (Relative Intensity Noise) of optical analog transmission LDs and optical transmitters, modulation degree, C/N, and the noise level of optical fiber amplifiers.

Characteristics

FREQUENCY RELATED
Frequency Range – 100 Hz to 8 GHz, R3265A. 100 Hz to 26.5 GHz, R3271A.

Harmonic Mode (N), R3265A – =1.

Harmonic Mode (N), R3271A –

Frequency Band	Harmonic Mode (N)
100 Hz to 3.6 GHz	1
3.5 to 7.5 GHz	1
7.4 to 15.4 GHz	2
15.2 to 23.3 GHz	3
23 to 26.5 GHz	4

Preselector – 3.5 GHz to 8 GHz (26.5 GHz for R3271A) using YIG-tuned preselector.

Frequency Readout Accuracy (Start, Stop, CF, Marker) – ±(freq. readout x freq. reference accuracy + span x span accuracy + 0.15 x res BW + 10 Hz).

Span Accuracy – Span >2 MHz: ±3%, Span ≤2 MHz: ±5%.

Count Frequency Marker –
Resolution: 1 Hz to 1 kHz.
Count accuracy (S/N >25 dB): ±(marker freq. x freq. reference accuracy + 5 Hz x N + 1 LSD).
Delta marker count accuracy: (S/N ≥25 dB) ±(delta marker freq. x freq. reference accuracy + 10 Hz x N + 2 LSD).

Frequency Reference Accuracy –
R3265A: $\pm 2 \times 10^{-8}$/day, $\pm 1 \times 10^{-7}$/year, $\pm 5 \times 10^{-9}$/day with Option 21.
R3271A: $\pm 2 \times 10^{-8}$/day, $\pm 1 \times 10^{-7}$/year, $\pm 5 \times 10^{-9}$/day with Option 21.

Frequency Stability –
Residual FM (zero span): <3 Hz x $N_{p\text{-}p}$/0.1 s.
Drift (after 1 hour warmup): Span 50 kHz <span ≤2 MHz, <2.5 kHz x sweep time (minute) x N. Span ≤50 kHz, <60 Hz x sweep time (minute) x N.

Spectral Purity – Noise sidebands.

Offset	f ≤2.6	f ≥2.6
1 kHz	<–100 dBc/Hz	≤(–95 + 20 logN) dBc/Hz
10 kHz	<–110 dBc/Hz	≤(–108 + 20 logN) dBc/Hz
20 kHz	<–110 dBc/Hz	≤(–108 + 20 logN) dBc/Hz
100 kHz	<–114 dBc/Hz	≤(–110 + 20 logN) dBc/Hz

Spectrum Analyzers
R3271A • R3371A • R3265A • R3365A

FREQUENCY SPAN

Linear Span –
Range (zero span): 200 Hz to 8 GHz (R3265A), 200 Hz to 26.5 GHz (R3271A). Accuracy: ±3% (span >2 MHz), ±5% (span ≤2 MHz).

Log Span –
Range: 1 kHz to 1 GHz 1, 2, 3 decades selected.
Accuracy: ±(10% + stop freq. x 0.1%).

Resolution Bandwidth (–3 dB) –
Range: 10 Hz to 3 MHz 1, 3, 10 sequence.
Accuracy: 100 Hz to 1 MHz: ±15%. 30 Hz to 3 MHz (25°C ±10°C): ±25%. 10 Hz to 100 Hz (digital IF): ±50%.
Selectivity (–60 dB/–3 dB): 100 Hz to 3 MHz: <15:1. 30 Hz: <20:1. 10 Hz to 100 Hz (digital IF): 5:1 (nominal).
Bandwidth (–6 dB): 200 Hz, 9 kHz, 120 kHz. Conformed to CISPR standard.

Video Bandwidth Range – 1 Hz to 3 MHz, 1, 3, 10 sequence.

AMPLITUDE RELATED

Amplitude Range – +30 dBm to noise level.

Maximum Input –
Average continuous power (Input attenuation ≥10 dB): +30 dBm (1 W). DC: 0V.

Display Range –
Scale calibration: 10x 10 division graticule.
Log: 10, 5, 2, 1, 0.5, 0.2, 0.1 dB/div.
Linear: 10% of reference level/div.
QP log: 40 dB (5 dB/div).

Input Attenuator Range – 0 to 70 dB (10 dB step).

DYNAMIC RANGE

Maximum Dynamic Range –
1 dB Compression-to-noise level:
R3265A: 200 MHz to 3.6 GHz
135 dB – 1.55f (GHz).
R3271A: 10 MHz to 3.6 GHz
130 dB – 1.55f (GHz).
Second harmonic distortion:
R3265A: 100 MHz to 1.8 GHz 87 dB. 10 MHz to 3.6 GHz 82.5 dB. >3.5 GHz 112 dB.
R3271A: 10 MHz to 3.6 GHz 85 dB.
>3.5 GHz 110 dB.
Third order intermodulation:
R3265A: >200 MHz, 93 dB.
R3265A, R3271A: >10 MHz, 90 dB.

Displayed Average Noise Level (10 Hz RBW, 0 dB 1/p attenuation, 20x average) –
R3265A and R3271A: 1 kHz, –100 dBm.
10 kHz, –110 dBm. 100 kHz, –111 dBm.
1 MHz, –135 dBm.
R3265A: 10 MHz to 3.6 GHz) Normal mode, –140 + 1.55f (GHz) dBm. Low-noise Mode, –145 – 1.55f (GHz) dBm. 3.5 to 8 GHz) –135 dBm.
R3271A: 1 MHz to 3.6 GHz –135 + 1.55f (GHz) dBm. 3.5 to 7.5 GHz –130 dBm. 7.5 to 15.4 GHz –123 dBm. 15.2 to 23.3 GHz –116 dBm. 23 to 26.5 GHz –110 dBm.

Gain Compression (1 dB) –
R3265A: >10 MHz, –10 dBm (mixer level). >250 MHz, –5 dBm (mixer level).
R3271A: >10 MHz, 5 dBm (mixer level).

Second Harmonic Distortion –
R3265A: 100 MHz to 1.8 GHz <–70 dBc (–30 dBm at mixer). 10 MHz to 1.8 GHz <–60 dBc (–30 dBm at mixer). >1.75 GHz <–100 dBc (–10 dBm at mixer).
R3271A: 10 MHz to 1.8 GHz <–70 dBc (–30 dBm at mixer). >1.75 GHz <–100 dBc (-10 dBm at mixer).

Third Order Distortion (30 dBm mixer level) –
R3265A: 200 MHz to 3.6 GHz <–70 dBc. 10 MHz to 3.6 GHz <–60 dBc). >3.5 GHz <–75 dBc.
R3271A: 10 MHz to 3.6 GHz <–70 dBc, >3.5 GHz <–75 dBc.

Image Multiple, Out-of-band Response –
R3265A: 10 MHz to 8 GHz <–70 dBc.
R3271A: 10 MHz to 18 GHz <–70 dBc. 10 MHz to 23 GHz <–60 dBc. 10 MHz to 26.5 GHz <–50 dBc.

Residual Response (no signal at 1/p, attenuator 0 dB, 50 Ω termination) –
1 MHz to 3.6 GHz <–100 dBm. 300 kHz to 8 GHz (26.5 GHz), <–90 dBm.

AMPLITUDE ACCURACY

Frequency Response – In band flatness (10 dB input attenuation): 100 Hz to 3.6 GHz ±1.5 dB. 50 MHz to 2.6 GHz ±1.0 dB. 3.5 GHz to 7.5 GHz ±1.5 dB.
R3265A, 7.4 GHz to 8 GHz ±1.5 dB.
R3271A, 7.4 GHz to 15.4 GHz ±3.5 dB.
15.4 GHz to 23.3 GHz ±4.0 dB. 23 GHz to 26.5 GHz ±4.0 dB.

Additional Uncertainly Due to Band Switching – ±0.5 dB.

Frequency Response Referenced to CAL Signal – ±3 dB (R3265A), ±5 dB (R3271A).

Calibrator Accuracy – –10 dBm ±0.3 dB.

IF Gain Uncertainty (after automatic calibration) – 0 dBm to –50 dBm: ±0.5 dB.
0 dBm to –80 dBm: ±0.7 dB.

Scale Fidelity –
Log: ±0.2 dB/1 dB, ±1 dB/10 dB, ±1.5 dB/90 dB.
Linear: ±5% of reference level.
QP mode log: ±1.0 dB/30 dB, ±2 dB/40 dB, ±1.0 dB/40 dB (25°C ±10°C).

Input Attenuator Switching Accuracy (20 to 70 dB settings referenced to 10 dB) –
±1.1 dB/10 dB step, 2.0 dB max., 0 to 12.4 GHz.
±1.3 dB/10 dB step, 2.5 dB max., 12.4 GHz to 18 GHz.
±1.8 dB/10 dB step 3.5 dB max., 18 GHz to 26.5 GHz.

Resolution Bandwidth Switching Uncertainty (at reference BW, 300 kHz, after automatic calibration) –
100 Hz to 3 MHz: ≤±0.3 dB. 30 Hz: ≤±1 dB.
10 Hz to 100 Hz (digital IF): ≤±1.5 dB.

Pulse Digitization Uncertainty (pulse response mode PRF >700/sweep time) Peak-to-Peak –
Log: RBW ≤1 MHz, 1.2 dB; RBW ≤3 MHz: 3 dB.
Linear: RBW ≤1 MHz, 4% of reference level; RBW 3 MHz, 12% of reference level.

SWEEP RELATED

Sweep Time –
SPAN = 0: 50 µs to 1000 s and manual sweep.
SPAN ≥200 Hz: 20 ms to 1000 s and manual sweep.
Accuracy: ±3%.

Sweep Trigger – Free run, line, single, video, TV-H, TV-V, external.

Demodulation –
Spectrum demodulation: Modulation type, AM and FM.
Audio output: Speaker and phone jack with volume control.
Marker pause time: 100 ms to 1000 s.

DELAYED SWEEP

Trigger Signal Source – External trigger signal (input from the external trigger input connector).
Trigger mode: VIDEO and TV-V.

Delay Time – 200 ns to 1.5 s with a resolution of 100 ns.

Delayed Sweep Time – 50 µs to 1000 s (resolution is the same as that set in the sweep time).

Spectrum Analyzers
R3271A • R3371A • R3265A • R3365A

GATED SWEEP
Trigger Signal Source – Frequency or time domain analysis: External trigger input (TTL), gate input (TTL), IF detection trigger (Trigger level variable, span ≤7 MHz – frequency domain analysis – 1/p pulse >100 µs).

Gate Position – 300 ns to 100 ns with resolution of 100 ns.

Gate Width – 1 µs to 1.5 s with resolution of 100 ns.

TRACKING GENERATOR (R3365A/R3371A)
Frequency Range – 100 kHz to 3.6 GHz.

Output Level Range – –3 dBm to –30 dBm (0.1 dB steps).

Output Level Accuracy – ±0.5 dB (25 MHz, –10 dBm, 25°C, ±10°C).

Vernier Accuracy – ±0.5 dB (25 MHz, –10 dBm, 25°C, ±10°C).

Dynamic Range –
1 MHz to 3 GHz –110 dBm.
3 GHz to 3.6 GHz –100 dBm.

Power Sweep Range – 30 dB (in 0.1 dB steps).

INPUTS/OUTPUTS
External Memory Function – IC memory card.

RF Input –
Connector type: N type (adaptable to SMA type for R3271A).
Impedance: 50 Ω (nominal).
VSWR (input attenuation ≥10 dB, at tuned frequency): ≤3.6 GHz (nominal): <2.0:1 (R3265A), >3.6 GHz (nominal) <2.5:1 (R3271A).
LO emission level (average): <–80 dBm (nominal), 10 dB input attenuation, 0 to 26.5 GHz.

Video Output –
Connector: BNC female, rear panel.
Impedance (AC coupled): 75 Ω (nominal).
Amplitude: Approx. 1 V p-p (composite video signal).

Probe Power –
Connector: 4-Pin, front panel.
Voltage: +15 V, –15 V.
Current: 150 mA max., each.

Demodulated Audio Output –
Connector: Subminiature monophonic jack, front panel.
Power output: 0.2 W, 8 Ω (nominal).

Phone Output – Demodulated audio.
Connector: Subminiature monophonic jack, front panel.
Power output: 0.2 W, 8 Ω (nominal).

GPIB Interface – Standard GPIB function enables remote operation and data input/output.
Connector: IEEE-488 bus connector.
Direct plotter output: Supports HP7470A, HP7475A, HP7440A, and HP7550A, or other HPGL plotters.

POWER REQUIREMENTS
Operating Voltage – Automatically selects between 100 V AC and 220 V AC.
100 V AC: 90 V to 132 V.
220 V AC: 198 V to 250 V.

Power Consumption – Max. 400 VA.

Frequency –
100 V AC: 48 to 440 Hz.
200 V AC: 48 to 66 Hz.

GENERAL SPECIFICATIONS
Environmental –
Operating temperature: 0°C to +50°C.
Nonoperating temperature: –20°C to +60°C.
Humidity: 85% RH.

Safety – This product has been safety tested by Advantest to IEC 348 specifications.

PHYSICAL CHARACTERISTICS

Dimensions*1	mm	in.
Height	177	7.0
Width	353	13.9
Depth	450	17.7
Weight	**kg**	**lb.**
Nominal	22	48.5

**1 Without handle, feet, and front cover.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

R3265A
Spectrum Analyzer.
Includes: Power Cord, BNC-to-BNC Cable, N-Type-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

R3365A
Spectrum Analyzer with Tracking Generator.
Includes: Power Cord, BNC-to-BNC Cable (short), BNC-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

R3271A
Spectrum Analyzer.
Includes: Power Cord, BNC-to-BNC Cable (short), BNC-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

R3371A
Spectrum Analyzer with Tracking Generator.
Includes: Power Cord, BNC-to-BNC Cable (short), BNC-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3) (R3271A/R3371A only).
Opt. D5 – Test Data (requires Opt. C5) (R3271A/R3371A only).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Q32605A
Optical Receiver.

PROBES
FET Probe – DC to 900 MHz (Requires 1101A). Order P6201.
FET Probe – DC to 500 MHz. (Requires 1101A) Order P6202A.
50 Ω Divider Probe – DC to 3.5 GHz 6 ft. Order P6156.
Current Probe – 935 Hz to 120 MHz. Order P6022.
Preamplifier – 9 kHz to 1 GHz ≥25 dB. Order R14601.
Memory Card – Set of five 32 KB Cards. Order A09505.
Memory Card – Set of five 128 KB Cards. Order A09506.
Aluminum Transit Case – Order R16059.
Rackmount Adapter – Order A02459.

ADDITIONAL ACCESSORIES
See page 438.
Cart – Order K420.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1.*

ADVANTEST
Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Spectrum Analyzers
R3272

Features

R3272

- Compact and Lightweight – 15 kg (33 lb.)
- 9 kHz to 26.5 GHz Frequency Measurement Range
- 300 Hz to 5 MHz Resolution Bandwidth
- –110 dBm Sensitivity at 7 GHz (1 kHz RBW)
- ±1% Span Accuracy
- Delayed and Gated Sweep
- Large TFT Color Liquid Crystal Display with Multi-screen Functionality
- 10 Markers
- Independent Function Keys for Ease of Operation
- Highly Reliable, Narrowband Sweep Capability Based on Direct Digital Synthesizer Technology
- GPIB and Centronics Interfaces
- Two PCMCIA Memory Card Slots

Applications

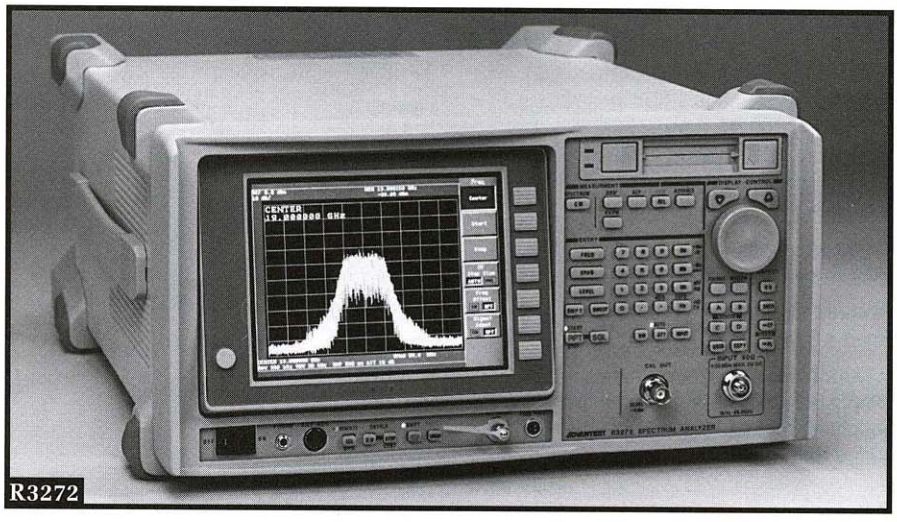
- Manufacturing, Installation, and Maintenance of Microwave Point-to-Point Links
- PCS Microwave Link Measurement
- Satellite Link Manufacture, Installation, and Maintenance

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.



R3272 9 kHz to 26.5 GHz Portable Spectrum Analyzer

Today's advanced information society is driven and supported by radio communications technology in which microwave and submillimeter wave communications are playing an increasingly important role.

The R3272 spectrum analyzer allows engineers to easily and quickly perform spectrum analysis of microwave and submillimeter wave bands. This high performance, portable spectrum analyzer covers a frequency range between 9 kHz and 26.5 GHz (up to 325 GHz using an external mixer) with an input range between +30 dBm and –120 dBm, an amplitude display dynamic range of 100 dB, and a resolution bandwidth of 300 Hz. In addition to these standard capabilities, the R3272 offers a 1 Hz resolution frequency counter.

The R3272 is optimized for radio and spurious measurements for microwave and satellite communication.

PORTABILITY ASSURES MOBILITY
The R3272 is designed to assure maximum mobility. A robust design, conforming to MIL standards that demand high tolerance to vibration and accidental drops, is impeccably housed within a compact package. This allows the engineer to quickly move to any remote location for on-the-spot testing.

USER-FRIENDLY PANEL DESIGN
The R3272 uses a TFT color LCD to provide a clear and accurate display of an array of data and information. The panel includes independent function keys, such as Occupied Bandwidth, Adjacent Channel Power, and Harmonic, for automatically locating Harmonics of a given signal. It also includes frequently used parameter setting keys for Bandwidth, Attenuation, and Sweeptime. Results are easily stored and accessed on PCMCIA memory cards.

Characteristics

MEASUREMENT FUNCTION
CW Mode – Spectrum measurement, power measurement, counter, spurious, OBW/ACP/HARM measurement.

FREQUENCY
Frequency Range –
Standard: 9 kHz to 26.5 GHz.
With external mixer: 18 GHz to 325 MHz.

Frequency Reference Accuracy –
$\pm 2 \times 10^{-8}$ /day, $\pm 1 \times 10^{-7}$ /year.

Frequency Stability –
Residual FM (zero span): $<(3\ \text{Hz} \times N_{p\text{-}p} / 0.1\ \text{s})$.
Drift (after 1 hour warmup): <(20 Hz x sweep time (minutes) x N).

Spectral Purity Noise Side Bands –

Offset	f ≤ 3	f > 3
10 kHz	<–100 dBc/Hz	<(98 + 20 log N) dBc/Hz
100 kHz	<–110 dBc/Hz	<(–108 + 20 log N) dBc/Hz

Spectrum Analyzers
R3272

Resolution Bandwidth (3 dB) –
Range (1, 3, 10 sequence): 300 Hz to 3 MHz, 5 MHz.
Accuracy: Resolution 1 kHz to 1 MHz: ±20%. Resolution 300 Hz, 3 MHz, 5 MHz: ±30%.
Selectivity: <15:1 (300 Hz to 5 MHz).

Video Bandwidth Range – Range (1, 3, 10 sequence): 1 Hz to 3 MHz, 5 MHz.

Frequency Span –
Linear span (zero span): 2 kHz to 26.5 GHz.

Accuracy: Span > 5 MHz: ±4%.
Span ≤ 5 MHz: ±1%.

DYNAMIC RANGE
Displayed Average Noise Level (Resolution Bandwidth 1 kHz, Input Attenuator 0 dB, Video Bandwidth 1 Hz) –

Frequency Range	Frequency Band (N)	Displayed Average Noise Level
10 kHz	1	–70 dBm
100 kHz	1	–80 dBm
1 MHz to 3.1 GHz	1	–(115 – 1.55 x f(GHz)) dBm
3.0 to 7.5 GHz	1	–110 dBm
7.4 to 15.4 GHz	2	–103 dBm
15.2 to 23.3 GHz	3	–96 dBm
23.0 to 26.5 GHz	4	–90 dBm

Spurious Response –
Second harmonic distortion:

Frequency Range	Second Harmonic Distortion	Mixer Level
10 MHz to 3 GHz	<–70 dBc	–30 dBm
>3 GHz	<–100 dBc	–10 dBm

Third harmonic distortion (12.5 kHz Separation, Resolution Bandwidth 300 Hz):

Frequency Range	Third Harmonic Distortion	Mixer Level
10 MHz to 3 GHz	<–75 dBc	–30 dBm
>3 GHz	<–75 dBc	–30 dBm

AMPLITUDE ACCURACY
Frequency Response –
10 dB input attenuation:

Frequency Range	In Band Flatness	Frequency Band (N)
9 kHz to 3.1 GHz	±1.5 dB	1
50 MHz to 3.1 GHz	±1.0 dB	1
3 to 7.5 GHz	±1.5 dB	1
7.4 to 15.4 GHz	±3.5 dB	2
15.4 to 23.3 GHz	±4.0 dB	3
23 to 26.5 GHz	±4.0 dB	4

Amplitude Range –
+30 dBm to noise level.

DISPLAY RANGE

10 x 10 Divisions –
Log: 10, 5, 2, 1, 0.5 dB/div.
Linear: 10% of reference level/div.

SWEEP
Sweep Time – 50 ms to 1000 s.

Accuracy – ±5%.

Sweep Trigger – Free, run, line, single, video, external.

ANALOG DEMODULATION
Spectrum Demodulation –
Modulation type: AM, FM.
Audio output: Speaker and phone jack with volume control.
Marker pause time: 100 ms to 1000 s.

CALIBRATOR
Accuracy – –10 dBm ±0.3 dB.

IF GAIN UNCERTAINTY
(after automatic calibration at 15° to 35°C) –
0 to –50 dBm: 0.5 dB.
0 to –70 dBm: 0.7 dB.

SCALE FIDELITY
(after automatic calibration at 15° to 35°C)

Log –
1 dB: ±0.2 dB
10 dB: ±1 dB
90 dB: ±1.5 dB.

Linear – ±15% of reference level.

INPUTS AND OUTPUTS
Front Panel –
1st LO output: Connector type: SMA female; Impedance: 50 Ω, nominal; Frequency range: 3.421 to 7.921 GHz Amplitude: >+5 dBm.
Memory card: Two IC memory card slots.

Rear Panel –
GPIB: IEEE 488 bus connector.
Centronics: D-Sub 25-Pin.

ENVIRONMENTAL CHARACTERISTICS
Operating Temperature – 0 to 50°C.

Non-operating Temperature – –20 to 60°C.

Humidity – ≤85% relative humidity.

POWER REQUIREMENTS
AC Line – 90 V to 132 V or 198 V to 250 V, auto-switching.

Line Frequency – 48 to 66 Hz.

Power Consumption – ≤300 V A.

PHYSICAL CHARACTERISTICS

Dimensions (without handle, feet, and front cover)

	mm	in.
Width	350	13.8
Height	178	7.0
Depth	420	16.5
Weight	**kg**	**lb.**
Net	15	33

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

R3272
9 kHz to 26.5 GHz Portable Spectrum Analyzer.
Includes: Power Cable, Input Cable, Connector Adapter, 6.3 A Power Fuse.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Memory Card – 64 KB card. Order A09507.

PROBES
FET Probe – DC to 900 MHz (Requires 1101A). Order P6201.
FET Probe – DC to 500 MHz. Order P6202A.
50 Ω Divider Probe – DC to 3.5 GHz 6 ft. Order P6156.
Current Probe – 935 Hz to 120 MHz. Order P6022.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ADVANTEST
Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Spectrum Analyzers

R3465 • New R3463 • New R3263

Features

R3465/NEW R3463

- 9 kHz to 8 GHz Frequency Response for Full Range of Digital Mobile Radio Frequencies (R3465)
- 9 kHz to 3 GHz Frequency Response Covering Digital Radio Frequencies (R3463)
- One Button Measurements of Occupied Bandwidth, Adjacent Channel Power, and Harmonics
- Options for Digital Radio Measurements Including GSM, PHS, PDC, NADC, and CDMA
- 6.5 in. TFT Color LCD Display
- Lightweight Portable – 16 kg (35.2 lbs.)
- Two PC Card (PCMCIA) Memory Card Slots

NEW R3263

Same features as R3463 except:

- GSM Measurement Option Available
- Designed for General-Purpose Burst Envelope/Burst Spectrum Analysis

Applications

- Digital Mobile Radio Transmitter Measurements of Spectrum, Time, and Modulation Characteristics
- NADC, PDC, PHS Mobile and Base Station Measurements (R3465/R3463)
- GSM Mobile and Base Station Measurements (Opt. 56 and 71)
- CDMA Mobile Phone Measurements (Opt. 61)
- CDMA Base Station Test (refer to R3465 Option R3561L Base Station Tester)

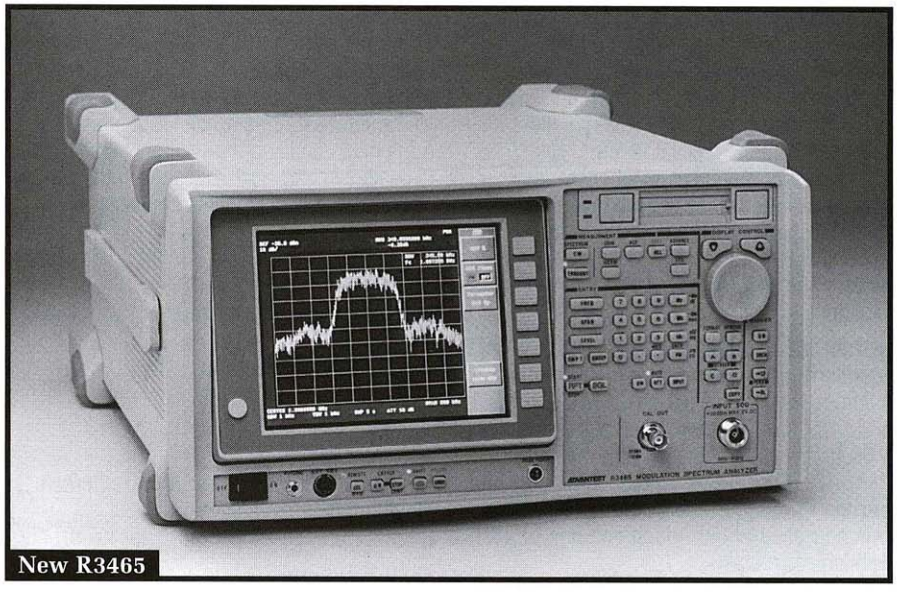
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2.*

See Tektronix on the World Wide Web: http://www.tek.com

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.



New R3465

R3465 8 GHz Modulation Spectrum Analyzer

The R3465 is a modulation spectrum analyzer that goes beyond traditional spectrum analysis. The 8 GHz frequency response provides coverage for a full range of digital radio frequencies. The 6.5 in. TFT color LCD display provides powerful support for multi-window operations. It also incorporates a 15-degree adjustable tilt mechanism for easy viewing under a variety of lighting conditions.

The R3465 is a high-performance spectrum analyzer armed with capabilities sufficient to support detailed waveform analysis. The newly developed high-speed settling synthesizer significantly reduces blanking time for narrow-band sweep (span of 5 MHz or less), thus enabling truly high-speed measurement. A high-frequency sweep accuracy of 1% or less, frequency stability of 2×10^{-8} /day, and a built-in preselector starting from 1.7 GHz permit harmonic measurements with a dynamic range of 100 dBc.

In addition to these powerful spectrum analyzer functions, the R3465 also offers built-in modulation analysis for a variety of digital mobile communication standards. Available options include measurement and graphics packages for CDMA, NADC/PDC/PHS, and GSM standards. For additional flexibility, the R3465 allows any two of these modulation standards to be resident in the instrument at the same time.

R3463 3 GHz Spectrum Analyzer

The R3463 provides similar performance to the R3465 over a 9 kHz to 3 GHz range. This range is adequate for many digital radio measurements at an economical price.

R3263 3 GHz Spectrum Analyzer

The R3263 represents an economical solution for general-purpose burst signal analysis. The basic unit shares the spectrum analyzer characteristics of the R3463 along with spectrum due to modulation, spectrum due to switching, in-band spurious, and zero-span burst envelope measurements. GSM measurement capability can be added with available options.

TRANSIENT MODE FOR DIGITAL ANALYSIS

In addition to the CW mode for conventional spectrum analysis, a TRANSIENT mode adds digital analysis capabilities including modulation accuracy and measurement of transmission speed. Measurement power is further enhanced by a FAST measurement function which enables significantly reduced measurement time.

Spectrum Analyzers
R3465 • New R3463 • New R3263

ONE-BUTTON MEASUREMENTS
The R3465/R3463 allow one-button measurement of occupied bandwidth, adjacent channel leakage power, and harmonic signals. Assigning frequently used measurement functions to special function keys frees the user from repetitive panel operations. Measurements can be started by a simple one-key operation. The SINGL key advances the measurement incrementally by each key stroke. The REPEAT key provides continuous, repetitive measurements.

AUTOMATIC STANDARD PARAMETER SETTINGS
Standard measurements of digital radio systems including PHS, PDC, NADC, CDMA, and GSM involve complicated parameter settings for each standard and measurement item. The R3465/R3463 has eliminated the burden for engineers by automating setting procedures, and one-touch settings of user-defined standards.

TWO PCMCIA MEMORY CARD SLOTS
Two memory card slots are provided to enable save/recall of system conditions as well as measurement results. On-screen displays can be saved in .BMP format for use in documentation.

EASY-TO-VIEW COLOR DISPLAY
A large, high-resolution, full-color TFT 6.5 in. LCD display provides powerful support for multi-window operations. Enhanced operability is provided by a 15-degree adjustable tilt mechanism.

CDMA MODULATION ANALYSIS (WITH OPTION 61)
With addition of Option 61, the R3465/R3463 performs CDMA transmission measurements in accordance with IS-95. This option provides cellular and PCS base/mobile station measurements in a single test set. In addition, it allows waveform quality analysis (rho) and code domain power measurements.

NADC/PDC/PHS MODULATION ANALYSIS
The R3465 and R3463 come standard with the ability to perform modulation analysis of NADC, PDC, and PHS signals. Measurements such as phase error, magnitude error, error vector magnitude, and I/Q origin offset can be made at the push of a button. Additional options allow for graphical display of these measurements as well as a constellation diagram and demodulated data.

GSM MODULATION ANALYSIS
With the addition of the GSM transmission options, the R3465 and R3263 can perform frequency error, phase error, and power vs. time measurements on GSM signals. Additional display options allow these results to be shown graphically, along with the demodulated data and an FFT of the phase error.

Characteristics

MEASUREMENT FUNCTIONS
CW Mode –
R3465/R3463: Spectrum, OBW, ACP, Harmonics.
R3263: Spectrum.

Transient Mode –
R3465/R3463: Time domain measurement, digital modulation analysis.
R3263: Burst envelope, burst spectrum.

FREQUENCY-RELATED
R3465 –
Frequency Range: 9 kHz to 8 GHz.

	Frequency Band	Harmonic Order (N)
9 kHz to 3.1 GHz	0	1
1.7 GHz to 7.0 GHz	1	1
6.9 GHz to 8.0 GHz	2	1

R3463/R3263 –
Frequency Range: 9 kHz to 3 GHz.

	Frequency Band	Harmonic Order (N)
9 kHz to 3 GHz	0	1

Frequency Readout Accuracy (Start, Stop, Center Frequency, Marker Frequency) –
±(frequency reading x frequency reference accuracy + span x span accuracy + 0.15 x Resolution BW + 10 Hz).

Marker Frequency Counter –
Resolution: 1 Hz to 1 kHz.
Accuracy (S/N ≥25 dB): ±(marker frequency x frequency reference accuracy + 5 Hz x N +1 LSD (Least Significant Digit)).
Delta Counter: ±(Δf x frequency reference accuracy + 10 Hz x N +2 LSD).

Frequency Reference Accuracy –
$\pm 2 \times 10^{-8}$/day;
$\pm 1 \times 10^{-7}$/year.

Frequency Stability –
Residual FM (ZERO span):
<3 Hz x N p-p/0.1 s.
Drift after 1 hour warmup (Span ≤5 MHz):
<20 Hz x Sweep Rate (minutes) x N.

Signal Purity –
10 kHz offset: <–100 dBc/Hz.
100 kHz offset: <–110 dBc/Hz.

Frequency Span –
Linear Span Range:
R3465: 2 kHz to 8 GHz, zero span.
R3463/R3263: 2 kHz to 3 GHz, zero span.
Accuracy:
Span >5 MHz: ±4%.
Span ≤5 MHz: ±1%.

Resolution Bandwidth (3 dB) –
Range (1, 3, 10 sequence): 300 Hz to 3 MHz, 5 MHz.
Accuracy:
1 kHz to 1 MHz: ±20%.
300 Hz, 3 MHz, 5 MHz: ±30%.
Selectivity (300 Hz to 5 MHz): <15:1.

Video Bandwidth Range (1, 3, 10 sequence) – 1 Hz to 3 MHz, 5 MHz.

Frequency Sweep –
Sweep time (CW mode, Spectrum Measurement): 50 ms to 1000 s.
Accuracy; ±5%.
Sweep Trigger: Free run, Line, Single, Video, External.
Trace Speed: 10 times/second.

Gated Sweep (R3465/R3463)–
Gate Position/Resolution: 1 µs to 65 ms in 1 µs steps.
Gate Width/Resolution: 2 µs to 65 ms in 1 µs steps.
Trigger: Internal IF detection, External.

AMPLITUDE-RELATED
Measurement Range – +30 dBm to average display noise level.

Maximum Safe Input Level –
Average Continuous Power (input attenuation ≥10 dB): +30 dBm (1 W).
DC Input: 0 V.

Display Range (10 x 10 Divisions) –
Log: 10, 5, 2, 1, 0.5 dB/div.
Linear: 10% of reference level/div (within 8 div).

Reference Level Range –
Log (0.1 dB steps): –105 to +60 dBm.
Linear (in approx. 1% steps of full scale): 1.25 µV to 223 V.

Input Attenuator Range – 0 to 70 dB in 10 dB steps.

Spectrum Analyzers
R3465 • New R3463 • New R3263

DYNAMIC RANGE
Average Displayed Noise Level (RBW 1 kHz, Input Atten 0 dB, Video Bandwidth 1 Hz) –

R3465

Frequency Range	Frequency Band	Displayed Average Noise Level
10 kHz	0	–70 dBm
100 kHz	0	–80 dBm
1 MHz to 3.0 GHz	0	–(115 – 1.55 x f (GHz)) dBm
1.7 GHz to 7.0 GHz	1	–115 dBm
6.9 GHz to 8.0 GHz	2	–115 dBm

R3463/R3263

Frequency Range	Frequency Band	Displayed Average Noise Level
10 kHz	0	–70 dBm
100 kHz	0	–80 dBm
1 MHz to 3.0 GHz	0	–(115 – 1.55 x f (GHz)) dBm
1.7 GHz to 3.0 GHz (R3463)	1	–115 dBm

1 dB Gain Compression – >10 MHz, –5 dBm (input mixer level).

Spurious Response –
2nd order harmonic distortion:

R3465

Frequency Range	2nd Order Harmonic Distortion	Mixer Level
10 MHz to 3.0 GHz	<–70 dBc	–30 dBm
>1.7 GHz	<–90 dBc	–30 dBm

R3463/R3263

Frequency Range	2nd Order Harmonic Distortion	Mixer Level
10 MHz to 3.0 GHz	<–70 dBc	–30 dBm

3rd Order Harmonic Distortion (12.5 kHz separation, resolution bandwidth 300 Hz, video bandwidth 3 Hz or less):

R3465

Frequency Range	3rd Order Harmonic Distortion	Mixer Level
10 MHz to 3.0 GHz	<–75 dBc	–30 dBm
>1.7 GHz	<–75 dBc	–30 dBm

R3463/R3263

Frequency Range	3rd Order Harmonic Distortion	Mixer Level
10 MHz to 3.0 GHz	<–75 dBc	–30 dBm

Image/Multiple/Out-Band Response –
R3465 (10 MHz to 8 GHz): <–70 dBc.
R3463/R3263 (10 MHz to 3 GHz): <–70 dBc.

Residual Response (no input signal, 0 dB input ATT., 50 Ω termination, wide span) –
1 MHz to 3.0 GHz: <–100 dBm.
300 kHz to 8 GHz:
R3465; <–90 dBm.
300 KHz to 3 GHz:
R3463/R3263: <–90 dBm.

AMPLITUDE ACCURACY
Frequency Response (Input Atten 10 dB) –

R3465

Frequency Range	Frequency Band	In Band Flatness
9 kHz to 3.0 GHz	±1.5 dB	0
50 MHz to 3.0 GHz	±1.0 dB	0
1.7 GHz to 7.0 GHz	±1.5 dB	1
6.9 GHz to 8.0 GHz	±1.5 dB	2

R3463/R3263

Frequency Range	Frequency Band	In Band Flatness
9 kHz to 3.0 GHz	±1.5 dB	0
50 MHz to 3.0 GHz	±1.0 dB	0

Additional Error Due to Band Switching (with reference to calibration signal) – ±3 dB.

Calibration Signal Accuracy (30 MHz) –
–10 dBm ±0.3 dB.

If Gain Error (after automatic calibration, resolution bandwidth 1 kHz to 5 MHz, 0 to -50 dBm) –
15° C to 35° C: ±0.5 dB.
0° C to 50° C: ±0.6 dB.

Scale Fidelity Accuracy (after automatic calibration) –

	15° C to 35° C	0° C to 50° C
Log	±0.2 dB/1 dB	±0.3 dB/1 dB
	±1 dB/10 dB	±1.2 dB/10 dB
	±1.5 dB/80 dB	±1.5 dB/80 dB
Linear	±15% of reference	±15% of reference
	level (within 8 div)	level (within 8 div)

Input Attenuator Switching Error (with reference to 10 dB at 20 to 70 dB) –
±1.1 dB/10 dB steps, maximum 2.0 dB over frequency range.

Resolution Bandwidth Switching Error (with reference to 300 kHz after automatic calibration, 3 x resolution bandwidth ≥span, 300 kHz to 3 MHz) –
15° C to 35° C: ≤±0.3 dB.
0° C to 50° C: ±0.5 dB.

Pulse Quantization Error (PRF > 500/sweep time in pulse measurement mode) –
Log:
Resolution bandwidth ≤1 MHz: 1.2 dB_{p-p}.
Resolution bandwidth = 3 MHz: 3 dB_{p-p}.
Linear:
Resolution bandwidth ≤1 MHz: 4% of reference level.
Resolution bandwidth = 3 MHz: 12% of reference level.

ANALOG DEMODULATION
Spectrum Demodulation –
Modulation Type: AM, FM.
Audio Output: Internal speaker, ear phone jack with volume control.

Demodulation Time – 100 ms to 1000 s.

TIME DOMAIN MEASUREMENT (R3465/R3463)
Amplitude Resolution – 10-Bit.
Sweep Time – 50 µs to 2 s.
Trigger – Free-run, Single, Video, IF detection, external.
Delayed Trigger Time – 200 ns to 650 ns.

DIGITAL MODULATION ANALYSIS (R3465/R3463)
Type – π/4 QPSK (PHS, PDC, NADC).

Input Range (–30 dBm to +30 dBm) –
R3465: 10 MHz to 7.5 GHz..
R3463: 10 MHz to 3.0 GHz.

Average Power Measurement Accuracy (transient mode, after calibration, automatic setting) –
15° C to 35° C: ±0.8 dB (within PHS/PDC/NADC band.
0° C to 50° C: ±1.0 dB (within PHS/PDC/NADC band.)

OBW – Standard measurement possible.

ACP – Measurement Range (Transient Frequency/CW mode):

PHS	PDC	NADC*1
0 dB to –57 dB	0 dB to –60 dB	0 dB to –55 dB
(600 kHz offset)	50 kHz offset)	(30 kHz offset)
0 dB to –62 dB	0 dB to –64 db	0 db to –60 dB
(900 kHz offset)	(100 kHz offset)	(60 kHz offset)
		0 dB to –60 dB
		(90 kHz offset)

**1Resolution bandwidth for NADC: 1 kHz.*

Spectrum Analyzers
R3465 • New R3463 • New R3263

Spurious Measurement Range (Transient Mode) – –20 to –65 dBC (–70 dBm or more).

Modulation Analysis (transient mode) –

	PHS	PDC/NADC
Frequency Error		
Range	±13 kHz	±1.4 kHz
Accuracy	Reference accuracy x carrier frequency + 5 Hz	
Modulation		
Range	0 to 30%	0 to 30%
Accuracy	±1% ±(measured value x ±2%)	±0.5% - ±(measured value x ±2%)
Transmission		
Accuracy	±1 ppm	±1 ppm

TRANSIENT RF ANALYSIS (R3263)

Burst Envelope Measurement –
Amplitude Resolution: 10-Bit.
Sweep Time: 50 µs to 2 s/100 ns (resolution).
Trigger: Free-run, Single, Video, IF Detection, External.

Burst Spectrum Measurement (with gated sweep) –
Gate Position/Resolution: 1 µs to 65 ms/1µs:
Gate Width/Resolution: 2 µs to 65 ms/1µs.
Trigger: Internal IF Detection, External.

GSM TRANSMITTER PLUS (R3465 OPT. 56, R3263 OPT. 55)

Modulation Mode – GMSK (GSM, DCS1800, DCS1900).

Analysis Range – 10 MHz to 3 GHz, –30 dBm to +30 dBm.

Average Power Measurement –
Measurement Accuracy (after automatic calibration, during automatic setting for GSM, DCS1800, DCS1900 bands):
15° C to 35° C: ±0.8 dB.
0° C to 50° C: ±1.0 dB.

Frequency Error/Phase Error Measurement –
Frequency Error:
Range: ±10 kHz.
Accuracy: Carrier frequency x frequency reference accuracy ±5 Hz.
Phase Error:
Range: 0 to 30° (peak).
Accuracy: ≤5° (peak), ≤±1° (RMS).

INPUTS AND OUTPUTS

RF Input –
Connector: Type N female.
Impedance: 50 Ω (nominal).
VSWR (Input Atten ≥10 dB, set frequency):
≤3.1 GHz: <1.5:1 (nominal).
≤1.7 GHz: <2.01 (nominal).

Calibration Signal Output –
Connector: BNC female, front panel.
Frequency: 30 MHz x (1± frequency reference accuracy).
Impedance: 50 Ω (nominal).
Amplitude: –10 dBm ±0.3 dB.

10 MHz Frequency Reference Input/Output –
Connector: BNC female, rear panel.
Output Impedance: 50 Ω (nominal).
Output Frequency Accuracy: 10 MHz x frequency reference accuracy.
Input/Output Amplitude Range: –5 dBm to +5 dBm.

21.4 MHz IF Output –
Connector: BNC female, rear panel.
Impedance: 50 Ω (nominal).

421 MHz IF Output –
Connector: BNC female, rear panel.
Impedance: 50 Ω (nominal).

Video Output –
Connector: VGA 15-Pin female, rear panel.
Output: Equivalent to 640 x 480 dots.

X Axis Output –
Connector: BNC female, rear panel.
Impedance: 1 kΩ (nominal), DC coupled.
Amplitude: Approx. –5 V to +5 V.

Y Axis Output –
Connector: BNC female, rear panel.
Impedance: 220 Ω (nominal).
Amplitude: Approx. 2 V in full scale (10 dB/div).

Z Axis Output –
Connector: BNC female, rear panel.
Amplitude: TTL level.
Sweep: HIGH level.
Blanking: LOW level.

External Trigger Input –
Connector: BNC female.
Impedance: 10 kΩ (nominal), DC coupled.
Trigger Level: TTL level.

Gate Input –
Connector: BNC female, rear panel.
Impedance: 10 kΩ (nominal).
Sweep Stop: While TTL LOW level.
Sweep: While TTL HIGH level.

Audio Output (demodulated audio signal) –
Connector: Small monophonic microphone jack, front panel.
Power Output: 0.2 W maximum, 8 Ω (nominal).

I/O –
GPIB: IEEE-488 bus connector, rear panel.
Parallel: D-SUB 25-Pin connector, rear panel.
RS 232: D-SUB 9-Pin connector, rear panel.
Direct Print: ESC/P, HP-PCL Commands.
Direct File Output: Saves .BMP files to PCMCIA cards.

Other –
External Keyboard: DIN connector, front panel.
Memory Card: Two memory card slots, front panel, JEIDA-Ver 4.2/PCMCIA2.1.

CDMA BASE STATION TESTING

Refer to page 271 for R3465 Option R3561L CDMA Base Station Tester.

ENVIRONMENTAL

Temperature – Operating: 0 to +50° C. Storage: –20° C to +60° C.

Humidity – 85% relative humidity or less.

POWER REQUIREMENTS

Line Voltage – 100 VAC/220 VAC, auto-switching.

Voltage Range –
100 V Operation: 100 V to 120 V.
220 V Operation: 220 V to 240 V.

Line Frequency – 50 Hz/60 Hz.

Power Consumption – 300 VA.

PHYSICAL CHARACTERISTICS

Dimensions (without handle, feet, front cover)

	mm	in.
Height	177	7.0
Width	350	13.8
Depth	420	16.5
Weight	**kg**	**lbs.**
	17	37.5

Spectrum Analyzers
R3465 • New R3463 • New R3263

R3465/R3463/R3263 SPECTRUM ANALYZER SELECTION GUIDE BY COMMUNICATION STANDARD

Standard	R3465 – 9 kHz to 8 GHz	R3463 – 9 kHz to 3 GHz	R3263 – 9 kHz to 3 GHz
GSM	R3465 Opt 56 (GSM Measurements only)	N/A	R3263 Opt. 55 (GSM measurements)
	R3465 Opt. 56 and 77 (GSM measurements with graphics)	N/A	R3263 Opt. 55 and 77 (GSM measurements with graphics)
CDMA	R3465 Opt. 61 (CDMA measurements/ constellation analysis with graphics, NADC measurements)	R3463 Opt. 61 (CDMA measurements/ constellation analysis with graphics, NADC measurements)	N/A
	R3465 Opt. R3561L Signal Generator (requires Opt. 61) for base station receiver testing.	R3463 Opt. R3561L Signal Generator (requires Opt. 61) for base station receiver testing.	N/A
NADC/PDC/PHS (All NADC measurements include PDC and PHS)	R3465 (standard) R3465 Opt. 75 (PDC/PHS/NADC measurements/constellation analysis) R3465 Opt. 76 (PDC/PHS/NADC measurements with graphics)	R3463 (standard) R3463 Opt. 75 (PDC/PHS/NADC measurements/constellation analysis) R3463 Opt. 76 (PDC/PHS/NADC measurements with graphics)	N/A N/A N/A
	R3465 Opt. 75 and 76 (PDC/PHS/NADC measurements/constellation analysis with graphics)	R3463 Opt. 75 and 76 (PDC/PHS/NADC measurements/constellation analysis with graphics)	N/A
GSM + CDMA	R3465 Opt. 56 and 61 (GSM measurements, CDMA measurements/constellation analysis with graphics)	N/A	N/A
	R3465 Opt. 56, 61, and 77 (GSM measurements with graphics, CDMA measurements/constellation analysis with graphics)	N/A	N/A
GSM + NADC	R3465 Opt. 51 (GSM measurements, NADC measurements)	N/A	N/A
	R3465 Opt. 51 and 77 (GSM measurements with graphics, NADC measurements)	N/A	N/A
	R3465 Opt. 51, 75, and 77 (GSM measurements with graphics, NADC measurements/constellation analysis)	N/A	N/A
	R3465 Opt. 51, 75, 76, and 77 (GSM measurements with graphics, NADC measurements/constellation analysis with graphics)	N/A	N/A
CDMA + NADC	R3465 Opt. 61 (NADC measurements, CDMA measurements/constellation analysis with graphics)	R3463 Opt. 61 (NADC measurements, CDMA measurements/constellation analysis with graphics)	N/A
	R3465 Opt. 61 and 75 (NADC measurements/ constellation analysis, CDMA measurements/ constellation analysis with graphics)	R3463 Opt. 61 and 75 (NADC measurements/ constellation analysis, CDMA measurements/ constellation analysis with graphics)	N/A
	R3465 Opt. 61, 75, and 76 (NADC measurements/constellation analysis with CDMA graphics, measurements/constellation analysis with graphics)	R3465 Opt. 61, 75, and 76 (NADC measurements/constellation analysis with graphics, CDMA measurements/constellation analysis with graphics)	N/A

Spectrum Analyzers

R3465 • New R3463 • New R3263

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

R3465
8 GHz Modulation Spectrum Analyzer.

R3463
3 GHz Modulation Spectrum Analyzer.

R3263
3 GHz Burst Spectrum Analyzer.
Includes: Power Cord (A01412), Input Cable (MC-61), Conversion Adapter (JUG-201A/U), 6.3 A Power Fuse (21806.3), Manual.

R3465/R3463/R3263 OPTIONS

Opt. 15 – Controller option for user-defined automated routines.

Opt. 51 – GSM measurements (R3465 only).

Opt. 55 – GSM measurements (R3263 only).

Opt. 56 – GSM measurements only (R3465 only).

Opt. 61 – CDMA transmitter measurements (Code domain power, waveform quality, I/Q measurements), CDMA constellation analysis with graphics.

Opt. 73 – FM Deviation Measurement.

Opt. 75 – PDC/PHS/NADC constellation analysis (R3465/R3463).

Opt. 76 – PDC/PHS/NADC graphics (R3465/R3463).

Opt. 77 – GSM Graphics (R3465/R3263)

Opt. 1R – Rackmount.

Opt. R3561L – Reverse link signal source for CDMA base station and mobile receiver simulation (R3465/R3463). Opt. 61 required.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – 3 years of Calibration Service.

Opt. C5 – 5 years of Calibration Service.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES

Memory Card – 64 KB PCMCIA card. Order A09507.

PROBES

FET Probe – DC to 900 MHz (Requires 1101A). Order P6201.

FET Probe – DC to 500 MHz. Order P6202A.

50 Ω Divider Probe – DC to 3.5 GHz, 6 ft. Order P6156.

Current Probe – 935 Hz to 120 MHz. Order P6022.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

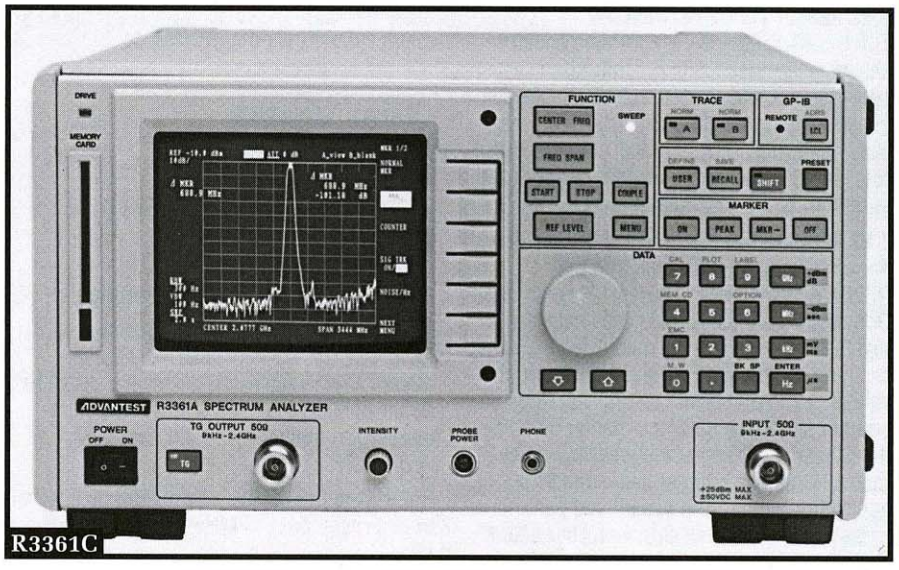
Spectrum Analyzers

R3361C • R3361CN • R3361D • R3261C • R3261CN • R3261D

Features

R3261C, R3261CN, R3261D, R3361C, R3361CN, R3361D

- Total Level Accuracy of 1 dB (Typical)
- User-defined Functions
- Measuring Window Function
- 120 dB Display Range
- Built-in Tracking Generator (R3361C, R3361CN, R3361D)
- CDMA Power Measurements (with Option 1K)



R3361C

R3261/R3361 Series Spectrum Analyzers

The R3261/R3361 Series spectrum analyzers use a synthesized technique to cover wide frequency bands: 9 kHz to 2.6 GHz (R3261C, R3361C) or 9 kHz to 3.6 GHz (R3261D, R3361D). These compact analyzers also offer high-performance functions, such as the 1 Hz resolution frequency setting function and 1 Hz resolution frequency counter function.

The R3261/R3361 Series spectrum analyzers are easy to operate because they incorporate unique features such as user-defined and measuring window functions. Weighing only 15 kg (33 lbs.) the analyzers are small and useful for measurement and analysis of all kinds, from manufacturing to research and development. The EMC measuring function, field strength measuring function, and audio-visual equipment analysis function for VCRs and 8-mm video equipment are also available.

The analyzers have an internal controller function (Option 15), parallel I/0, and GPIB interface for line connection and automatic measurement, so the user can create the optimum system configuration.

CHOOSE FROM SIX MODELS, DEPENDING UPON YOUR APPLICATION

The R3261/R3361 Series consists of six models. All models feature high performance and a set of features and functions for various applications.

	R3261C	R3261CN	R3261D	R3361C	R3361CN	R3361D
Frequency Range	9 kHz to 2.6 GHz	9 kHz to 2.6 GHz	9 kHz to 3.6 GHz	9 kHz to 2.6 GHz	9 kHz to 2.6 GHz	9 kHz to 3.6 GHz
Input Impedance	50 Ω	75 Ω	50 Ω	50 Ω	75 Ω	50 Ω
Internal Tracking Generator	Not available	Not available	Not available	Standard	Standard	Standard
Memory Card	Standard	Standard	Standard	Standard	Standard	Standard
Controller Function	Opt. 15	Opt. 15	Opt. 15	Opt. 15	Opt. 15	Opt. 15
Occupied Bandwidth Measurement, Adjacent-channel Leakage, Power Measurement	Standard	Standard	Standard	Standard	Standard	Standard
Burst Signal Analysis	Opt. 12	Opt. 12	Opt. 12	Opt. 12	Opt. 12	Opt. 12
CDMA Power Measurement	Opt. 1K	N/A	Opt. 1K	Opt. 1K	N/A	Opt. 1K

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Spectrum Analyzers

R3361C • R3361CN • R3361D • R3261C • R3261CN • R3261D

1 HZ RESOLUTION SYNTHESIZER
The R3261/R3361 Series portable spectrum analyzers are based upon a synthesized system, so the center and start/stop frequencies can be set with a resolution of 1 Hz. The synthesizer, featuring 1 Hz resolution, is a powerful tool ideal for waiting, receiving, or spot measurement in the zero-span mode.

1 HZ RESOLUTION FREQUENCY COUNTER
The frequency counter built into the R3261/R3361 Series features 1 Hz resolution. One of the advantages of these analyzers is that they can measure the modulated frequency or spurious frequency of a radio system that cannot be measured with an ordinary frequency counter simply by setting a marker. In addition, the ability to measure weaker signals than a frequency counter can extend the application range from broadband panoramic measurement to weak signal measurement.

MANUAL SWEEP FUNCTION FOR SPOT MEASUREMENT
EMC measurements using the quasi-peak (QP) detector require an extended sweep time. However, the time required to measure the peak value can be shortened using the manual sweep function.

CREATE YOUR OWN UNIQUE MENU
The R3261/R3361 Series spectrum analyzers are very functional and very easy to use because of the user-defined functions:

- **User-defined function.** The user can define a necessary function on the USER key in the same way as on the function keys of a personal computer. A unique menu can be created.
- **Define function.** The define function enables the user to change the software key menu manually. With this function, you can create a unique system by changing the key functions that were defined before the system was shipped from the factory.

FAST MEASUREMENT WITH MEASURING WINDOW FUNCTION
The R3261/R3361 Series allows the user to define both frequency and level ranges within a span for analysis. This powerful tool enables faster measurement times over frequencies and levels of interest.

Option 1K includes a suite of CDMA test routines which can be accessed through softkey menus. Specific CDMA measurements include channel power, total power across the span, average power, and peak power. The softkey menu for a test along with measured data (waveforms) can be stored in memory cards via the front panel.

Characteristics

FREQUENCY RELATED

Measuring Frequency Range –
R3261C, R3261CN, R3361C, R3361CN: 9 kHz to 2.6 GHz.
R3261D, R3361D: 9 kHz to 3.6 GHz.

Central Frequency Setting Resolution – 1 Hz.

Central Frequency Display Accuracy –
Span ≤2 MHz: ±(3% of span + central frequency x reference oscillator accuracy + 20 Hz).
Span >2 MHz: +(2% of span + central frequency x reference oscillator accuracy + 20 kHz).

Reference Oscillator – Switching by internal or external input (10 MHz).

Internal Reference Oscillator Stability –
+2 x 10^{-8}/day, ±2 x 10^{-7}/year.

Frequency Span –
Linear mode: R3261C/CN, R3361C/CN, 1 kHz to 2.6 GHz and zero. R3261D/R3361D, 1 kHz to 3.6 GHz and zero.
Log mode: 1, 2, or 3 decades selected between 10 kHz and 1000 MHz.

Frequency Span Accuracy –
Span <2 MHz: ≤±3% of span.
Span >2 MHz: ≤±5% of span.

Frequency Stability – Residual FM:
10 MHz ≤ span < 2 MHz, 50 kHz p-p or less.
Span >2 MHz, 2 kHz p-p or less.
Span ≤2 MHz, 20 Hz p-p or less.
Frequency drift: Span ≤2 MHz, 300 Hz/min. or less.

Sideband Noise – At 20 kHz offset
f ≤ 3.0 GHz, –105 dBc/Hz;
f ≤ 3.6 GHz, –101 dBc/Hz.

Resolution –
3 dB bandwidth: 30 Hz to 1 MHz; switchable in 1 to 3 steps.
6 dB bandwidth: 200 Hz, 9 kHz, 120 kHz.
Selectivity: ≤15:1 (60 dB: 3 dB).
Bandwidth accuracy: ≤20%.

Marker Accuracy –
Normal mode: Central frequency display accuracy + span accuracy.
Counter mode: Display frequency x reference oscillator accuracy ±1 count.

AMPLITUDE RELATED

Amplitude Measuring Range –
R3261C, R3261D, R3361C, R3361D: –130 dBm to +25 dBm.
R3261CN, R3361CN: –19 dBµV to +132 dBµV.

Screen Display Range –
Log mode: 10 dB/div, 120 dB. 10 dB/div, 80 dB. 5 dB/div, 50 dB. 2 dB/div, 20 dB. 1 dB/div: 10 dB.
Linear mode: 10 div.
QP mode: 80 dB (10 dB/div) when measuring range is 70 dB.

Display Linearity –
Log mode: ±2.0 dB/110 dB, ±1.5 dB/70 dB, ±1.0 dB/10 dB, ±0.2 dB/1 dB.
Linear mode: ±5% of full scale.
QP mode: ±2.0 dB/70 dB, ±1.0 dB/40 dB.

Reference Level Display Range –
R3261C, R3261D, R3361C, R3361D: –109.9 dBm to +40.0 dBm, 0.715 µV to 22.4 V.
R3261CN, R3361CN: +0.1 dBµV to +150 dBµV, 1.01 µV to 31.6 V.

Reference Level Accuracy (after automatic calibration) –

	R3261C/R3261D R3361C/R3361D	R3261CN R3361CN
<±0.3 dB	0 dBm to –50 dBm	+110 dBµV to +60 dBµV
<±0.7 dB	+20 dBm to –70 dBm	+130 dBµV to +40 dBµV

Dynamic Range

Average Noise Level – (resolution bandwidth – 300 Hz, Video bandwidth 1 Hz, Input attenuator 0 dB, Frequency range 10 MHz or more):
R3261C, R3261D, R3361C, R3361D: –120 dBm + 1.55 f (GHz) dB. R3261CN, R3361CN: –10 dBµV +1.55 f (GHz) dB.

Secondary and Tertiary Distortion –
≤–70 dB at –30 dBm input, Input attenuator 0 dB, Frequency 10 MHz or more.

Frequency Response –

	R3261C/R3261D R3361C/R3361D	R3261CN R3361CN
100 Hz to 2 GHz	≤+0.5 dB	≤+0.5 dB
9 kHz to 2.6 GHz	≤+1.0 dB	–
9 kHz to 3.6 GHz	–	≤+1.5 dB

Residual Response –
R3261C, R3261D, R3361C, R3361D: ≤–100 dB (Termination: 50 Ω). R3261CN, R3361CN: ≤–11 dBµV (Termination 75 Ω).

Resolution Bandwidth Switching Accuracy –
≤±0.3 dB after automatic calibration.

Video Filter – 1 Hz to 1 MHz; switchable in 1 or 10 steps.

SWEEP RELATED

Sweep Time – 50 ms to 1000 s and manual sweep.

Spectrum Analyzers

R3361C • R3361CN • R3361D • R3261C • R3261CN • R3261D

Sweep Time Accuracy – ≤3%.

Trigger Modes – FREE RUN, LINE, VIDEO, EXT, TV-V, and SINGLE.

TRACKING GENERATOR SPECIFICATIONS (R3361C, R3361CN, R3361D)

Frequency Range –
R3361C/R3361CN: 9 kHz to 2.6 GHz.
R3361D: 9 kHz to 3.6 GHz.

Output Level Range –
R3361C, R3361D: 0 dBm to –50 dBm.
R3361CN: +105 dBµV to 55 dBµV setting in 1 dB steps.

Output Level Accuracy – ≤±0.5 dB (30 MHz, –10 dBm, 20°C to 30°C).

Output Level Flatness –

	R3361C/R3361D (at –10 dBm output)	R3361CN (at +95 dBµV output)
100 kHz to 1.0 GHz	≤0.7 dB	≤0.7 dB
9 kHz to 2.6 GHz	≤1.5 dB	≤1.5 dB
9 kHz to 3.6 GHz	≤2.0 dB	≤2.0 dB

Output Level Switching Accuracy (at 0 dBm/+95 dBµV output) –
100 kHz to 1.0 GHz: ≤±1.0 dB.
9 kHz to 2.6 GHz: ≤±2.0 dB.
9 kHz to 3.6 GHz: ≤±3.0 dB.

Output Spurious (at 0 dBm/+105 dBµV output) –
Harmonic spurious: ≤–20 dB.
Non-harmonic spurious: ≤30 dB.

Tracking Generator Leakage –
R3361C/R3361D: Frequency ≤3.0 GHz, ≤–110 dBm. Frequency ≤3.6 GHz, ≤–100 dBm.
R3361CN: ≤+1 dBµV.

Output Impedance –
R3361C, R3361D: Approximately 50 Ω.
R3361CN: Approximately 75 Ω.

Output VSWR (at ≤–10 dBm/+95 dBµV output) – 100 Hz to 2 GHz: ≤1.5. 9 kHz to 3.6 GHz: ≤2.0.

Output Connector – N type.

INPUT RELATED

Input Impedance –
R3261C, R3261D, R3361C, R3361D: 50 Ω.
R3261CN, R3361CN: 75 Ω.

VSWR (at input attenuator ≥10 dB) –
100 kHz to 2 GHz: ≤1.5.
9 kHz to 3.6 GHz: ≤2.0.

Input Connector – N type.

Maximum Input Level –
R3261C, R3261D, R3361C, R3361D: +25 dBm (attenuator ≥30 dB), 50 V DC max.
R3261CN, R3361CN: +132 dBuV (attenuator ≥30 dB), ±50 V DC max.

Input Attenuator – 0 to 50 dB in 10 dB steps.

Input Attenuator Switching Accuracy – ≤1.0 dB (≤2.0 GHz), ≤1.5 dB (≤3.6 GHz) at input attenuator 10 dB.

Detection Modes – NORMAL, POSI, NEGA, and SAMPLE.

INPUTS/OUTPUTS

External Memory Function – IC memory card.

GPIB Data Output/Remote Control – Data output and remote control through internal GPIB interface.

Direct Plotting – Hardcopy output of all display data to Tektronix HC100 Option 01, or other HPGL plotters through internal GPIB interface.

Voice Monitor Output – AM and FM with approximately 8 Ω earphone.

Probe Power Source: – ±15 V, 4-Pin connector.

ENVIRONMENTAL

Ambient Temperature – 0°C to +50°C.
Relative Humidity: 85% or less.

Storage Temperature – –20°C to +60°C.

Safety – This product has been safety tested by Advantest to IEC 348 specifications.

POWER REQUIREMENTS

Operating Voltage –
Standard: 90 to 132 V.
Option 40: 198 to 250 V.

Power Consumption – Less than 220 VA.

Frequency – 48 to 66 Hz.

CRT – 5.5 in.

PHYSICAL CHARACTERISTICS

Dimensions (approx.)	mm	in.
Height	177	7.0
Width	330	13.0
Depth	450	17.7
Weight	**kg**	**lbs.**
R3261C/CN/D	15	33
R3361C/CN/D	17	37.5

Spectrum Analyzers

R3361C • R3361CN • R3361D • R3261C • R3261CN • R3261D

K475

- Stable/Mobile Platform
- Tiltable Shelf for Optimum Viewing
- Work-bench Height
- Heavy-duty Nylon Instrument Straps
- Surge and Noise Suppression
- Surge-protected Four Outlet Power Strip Accessory
- Shipped Ready to Assemble

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

R3261C
2.6 GHz, 50 Ω Spectrum Analyzer.
Includes: Power Cord, BNC-to-BNC Cable, N-to-BNC Adapter, Memory Card, Instruction Manual.

R3261CN
2.6 GHz, 75 Ω Spectrum Analyzer.
Includes: Power Cord, BNC-to-BNC Cable, N-to-BNC Adapter, Memory Card, Instruction Manual.

R3261D
3.6 GHz, 50 Ω Spectrum Analyzer.
Includes: Power Cord, BNC-to-BNC Cable, N-to-BNC Adapter, Memory Card, Instruction Manual.

R3361C
2.6 GHz, 50 Ω Spectrum Analyzer with Tracking Generator.
Includes: Power Cord, BNC-to-BNC Cable(2), N-to-BNC Adapter (2), Memory Card, Instruction Manual.

R3361CN
2.6 GHz, 75 Ω Spectrum Analyzer with Tracking Generator.
Includes: Power Cord, BNC-to-BNC Cable(2), N-to-BNC Adapter (2), Memory Card, Instruction Manual.

R3361D
3.6 GHz, 50 Ω Spectrum Analyzer with Tracking Generator.
Includes: Power Cord, BNC-to-BNC Cable(2), N-to-BNC Adapter (2), Memory Card, Instruction Manual.

Opt. 81 – Gated Sweep Plus RS-232; Gated Sweep Plus Controller Function (including Parallel I/O and Serial I/O); 198 to 250 V AC operation; CDMA Power Measurements.

MEASUREMENTS SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES

PROBES

FET Probe – DC to 900 MHz (Requires 1101A). Order P6201.

FET Probe – DC to 500 MHz. (Requires 1101A). Order P6202A.

50 Ω Divider Probe – DC to 3.5 GHz, 6 ft. Order P6156.

Current Probe – 935 Hz to 120 MHz. Order P6022.

Carrying Case – Order R16211A.

Front Cover – Order A02804.

Transit Case – Order R16056A.

Memory Card – Set of Five 32 KB Cards. Order A09505.

Memory Card – Set of Five 128 KB Cards. Order A09506.

Preamplifier – 9 kHz to 1 GHz, ≥ 25 dB. Order R14601.

Rackmount Set – Conforms to EIA Standards. Order A02455.

ADDITIONAL ACCESSORIES

Also see page 438.

Cart – Order K475.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Spectrum Analyzers
R4131D

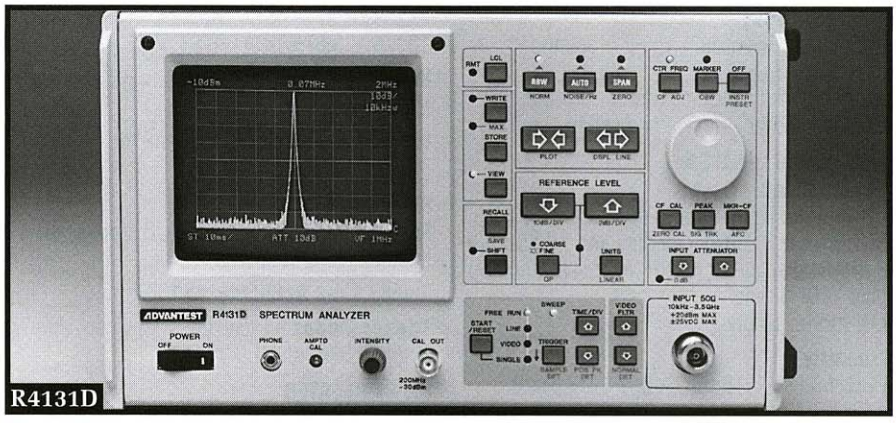
Features

R4131D

- 10 kHz to 3.5 GHz Coverage
- Excellent Phase Noise Sideband Characteristics: –80 dBc @ 20X Resolution Offset
- Small and Light, Weighing Only 10 kg (22 lbs.)
- Save/Recall Measurement Conditions, Including Waveforms
- Low Price

Applications

- EMC Diagnostic Measurement
- Spectrum Monitoring



R4131D Spectrum Analyzer

The R4131D Spectrum Analyzer is small, light, and affordable. Its wide frequency range accommodates measurement of PCS MDS, and other 2 GHz band signals, plus harmonic distortion of RF signals. Maximum input sensitivity of –116 dBm, dynamic range of 70 dB, and –80 dBc phase noise characteristic enhance the range of signals that can be measured with the R4131D. AFC tuning enhances the stability of this economical spectrum analyzer.

Built-in quasi-peak detector and EMC resolution bandwidth filters enable diagnostic EMC measurement. Automated measurements and data logging are complimented by a GPIB communication interface.

SAVE/RECALL FUNCTION FOR CONDITIONS AND WAVEFORMS

The R4131D has a save/recall function which operates not only for measurement condition settings but for waveforms as well. Three sets of conditions and waveforms are stored and recalled. This enables a stored waveform to be used as a reference in comparison measurements at different locations. Independent from this function is an auto-recall function that automatically sets the desired measurement conditions when power is switched on – a great convenience in making on-site measurements.

WIDE DYNAMIC RANGE FOR FREQUENCY CHARACTERISTIC MEASUREMENTS

The R4131D can be combined with the TR4153B or TR4154 Tracking Generators to enable frequency characteristic measurements with wide dynamic range.

AUTOMATIC MEASUREMENT OF OCCUPIED BANDWIDTH

The R4131D has an optional automatic occupied-bandwidth measurement function. This function automatically determines the bandwidth within which 99% of the radiated power is contained, indicating the bandwidth markers and displaying values digitally.

Characteristics

FREQUENCY RELATED

Frequency Range – 10 kHz to 3.5 GHz.

Center Frequency Display – Displayed on the CRT with a maximum resolution of 1 kHz.

Center Frequency Display Accuracy (after zero calibration at local feed through) – ±100 kHz ±3% of span, <2.5 GHz at a sweep time of 5 ms/div to 0.5 s/div); ±10 MHz, ≥2.5 GHz.

Frequency Span – 50 kHz to 4 GHz in 10 divisions on the horizontal scale on the CRT, selectable in 1-2-5 sequence. With zero span, operates as a fixed tuned receiver.

Frequency Span Accuracy – ±5%.

Stability – Frequency stability (at fixed frequency, after 30-minute warm-up): 10 kHz max/10 minutes ≤2.5 GHz at sweep time of 5 ms/div to 0.5 s/div. Residual FM: 2 kHz p-p max/100 ms.

Noise Sideband – –80 dBc max at resolution bandwidth of 1 kHz (at 20 kHz from the carrier, with a 10 Hz video filter).

Resolution –
Resolution bandwidth (3 dB points): 1 kHz to 1 MHz in 1, 3, 10 sequence.
Resolution bandwidth (6 dB points): 9 kHz, 120 kHz, when QP mode is selected.
Selectivity (ratio of 60 dB:3 dB resolution bandwidths): 15:1 max.
Resolution bandwidth accuracy: ±20%, CISPR standard or better in QP mode.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Spectrum Analyzers
R4131D

Marker Display –
Resolution: Maximum 1 kHz (depends on span).
Measurement accuracy: Center frequency display accuracy + frequency span accuracy.

AMPLITUDE RELATED
Screen Display Range –
LOG mode: With respect to reference level 80 dB for a 10 dB/div display and 20 dB for a 2 dB/div display, or 40 dB for a 5 dB/div display in QP mode.
LIN mode: 10 div.

Linearity –
LOG mode: ±0.15 dB/1 dB, ±1 dB/10 dB, ±1.5 dB/70 dB.
LIN mode: ±5% of full scale.

Reference Level –
LOG mode: –69 dBm to +40 dBm (for 10 dB/div, 10 dB and 1 dB steps, and for 1 dB/div and 5 dB/div, 1 dB and 0.25 dB steps).
LIN mode: 72.77 µV to 22.36 V.

Reference Level Accuracy – ±1 dB in LOG mode (in the reference level range of 0 to –59 dBm at 200 MHz, with attenuation at 10 dB after level calibration).

Reference Level Units – Selectable as dBm, dBµV, dBmV, or dBµV/m. When dBµV/m is selected, an automatic correction is made for the antenna calibration factor.

Marker Display –
Resolution: 0.2 dB (for 10 dB/div) or 0.05 dB (for 2 dB/div).
dBm/Hz: RMS noise level is displayed normalized with respect to the 1 Hz bandwidth noise at the marker position.

Dynamic Range –
Average noise level: –116 dBm + 1.55 f (GHz) dB or less.
2nd and 3rd order distortion: 70 dB down or greater (when input level is –30 dBm, at 10 MHz or above).
Frequency response (with 10 dB attenuation): ±1 dB or less (100 kHz ≤ F ≤ 2 GHz); ±2 dB or less (10 kHz ≤ F ≤ 3.5 GHz).
Residual response (with attenuation 0 dB, input termination 50 Ω, frequency >100 kHz): –100 dBm or less.

Video Filter – 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 300 kHz, 1 MHz.

Resolution Bandwidth Switching Accuracy – ±1 dB (+20°C to 30°C).

Gain Compression – 1 dB max for –10 dBm input.

SWEEP RELATED
Sweep Time – 5 ms/div to 100 s/div selectable in 1-2-5 sequence.

Sweep Time Accuracy – ±15%.

Trigger Modes – Free-run, line, video, and single (reset, start).

INPUT RELATED
RF Input – Approx. 50 Ω, N connector.

Maximum Input Level – +20 dBm, ±25 V DC max (with 20 dB or greater input attenuation).

Input Attenuator – 0 to 50 dB in 10 dB steps.

Input Attenuator Switching Accuracy – ±1 dB (10 kHz ≤ F ≤ 2 GHz) or ±1.5 dB (2 GHz ≤ F ≤ 3.5 GHz) with respect to 10 dB attenuation.

Input VSWR (at 10 dB input attenuation or greater) – 1.5 max (100 kHz ≤ F ≤ 2 GHz); 2.0 max (2 GHz ≤ F ≤ 3.5 GHz).

DISPLAY RELATED
Display – Waveform, setting conditions, grid.

CRT – 5.5 in., phosphor, amber display.

Trace – WRITE waveform and VIEW waveform (up to 2 waveforms displayed on the CRT).

WRITE – Posi-peak, sample, and posi-neg display.

MAX HOLD – For every repetition from the beginning of the function, the maximum signal level along the horizontal axis is displayed.

MARKER – Frequency and level at the marker point are measured and displayed.

PEAK SEARCH – The marker is moved to the point of maximum level on the displayed waveform.

MRK CF – The center frequency is changed to the marker frequency.

ZERO CAL – Improves the center frequency accuracy for local feed through.

PLOT – Direct plotting via GPIB.

NORMALIZE – Display of values relative to an internally stored reference response.

SAMPLE – Display of instantaneous time-signal levels at each analysis position for each sweep.

OUTPUT RELATED
Calibration Output Signal – 200 MHz ±30 kHz, –30 dBm ±0.5 dB.

Monitor Output – Approx. 8 Ω, enables monitoring using an earphone.

Recorder Outputs (analog output of WRITE waveform only) – X axis: Approx. –5 V to +5 V (approx. 10 kΩ). Y axis: Approx. 0 V to +4 V (approx. 220 Ω).

IF Output – 3.58 MHz IF output, approx. 50 Ω.

Video Output – Approx. 1 V p-p, approx. 75 Ω (composite signal for external CRT).

Probe Power Output – ±15 V, 4-Pin connector.

GPIB – Fully controllable over the GPIB for automatic testing as well as direct plotting without an external controller.

POWER REQUIREMENTS
Line Voltage – 90 to 132 V.

Line Frequency – 50/60 Hz.

Power Consumption – 120 VA max.

GENERAL SPECIFICATIONS
Save/Recall – Up to three sets of measurement conditions, including waveforms, can be stored in memory and auto-recall can be used to automatically recall stored conditions when power is applied.

Temperature – Operating: 0°C to +50°C. Storage: –20°C to +70°C.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	300	11.8
Height	177	7.0
Depth	460	18.1
Weight	**kg**	**lbs.**
Net	10	22

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative,inside the U.S. see the price list in the back of this catalog.

R4131D
Spectrum Analyzer.
Includes: Power Cable, Input Cable, N-to-BNC Adaptor.
Opt. 14 – Occupied Bandwidth Measurement and 3 dB Down Measurement.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES Also see page 438.
Preamplifier – 9 kHz to 1 GHz, ≥25 dB. Order R14601.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

Spectrum Analyzers

New U3641/N • New U4342 • U4941/N

Features

NEW U3641/U3641N

- 9 kHz to 3 GHz Frequency Range
- Ultra-Compact and Light Weight – 15 lbs.
- Three-way Power Supply – AC Line, External DC, and Optional Battery Pack
- 6 in. TFT Color LCD Display
- Synthesized Local Oscillator Yields High-Stability Measurements
- Two PCMCIA Memory Card Slots
- Switchable Preamp for High-Sensitivity Measurements
- Optional Internal Tracking Generator
- Built-In Adjacent Channel Power, Occupied Bandwidth, and Channel Power Measurements

U4941/U4941N Same as U3641/U3641N except:

- 9 kHz to 2.2 GHz Frequency Response
- Does Not Include Synthesized Local Oscillator

NEW U4342 Same as U4941 plus:

- Built-In Internal Tracking Generator

Applications

NEW U3641/U3641N

- Digital Mobile Communications Field Measurements (TDMA or CDMA, PCS and Cellular)
- Spectrum Monitoring
- RF Component Testing with Internal Tracking Generator Option
- Fault Location in Antenna Feeds with BasePak Software

U4941/U4941N/U4342 Same as U3641 plus:

- EMC Field Measurements

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

New U3641

U3641/U3641N Field Portable Spectrum Analyzers

The U3641/N is a 3 GHz synthesized spectrum analyzer ideal for applications where portability is a must. With a base unit weight of 15 lbs. and the ability to run from AC, DC, or optional battery power sources, the U3641/N has been designed specifically to meet the needs of field installation and maintenance applications. The synthesized local oscillator allows high-precision and high-stability measurements. Furthermore, the unit features optional resolution bandwidths down to 100 Hz. A fast zero span sweep speed of 50 µs allows characterization of TDMA signals, and its built-in measurement functions allow for easy verification of communication standard compliance.

The U3641/N can be customized for a variety of applications by selecting from a wide range of available options.

U4941/U4941N/U4342 RF Field Analyzers

The U4941/N/U4342 spectrum analyzers provide the same portability and ruggedness as the U3641/N in a more economical, non-synthesized instrument. These analyzers cover a frequency range of 9 kHz to 2.2 GHz, also making them useful for cellular and PCS communications applications. In addition to functions shared with the U3641/N, the U4941/N/U4342 are well suited for EMI measurements with built-in quasi-peak detector and EMC filters.

Spectrum Analyzers
New U3641/N • New U4342 • U4941/N

WIDE ARRAY OF ANALYSIS FUNCTIONS
Along with functions such as a frequency counter with a 1 Hz resolution and a 20 dB gain preamplifier, these analyzers come standard with measurement functions such as third order intermodulation distortion, percent AM, occupied bandwidth, and adjacent channel leakage power. GO-NO GO evaluations of the displayed waveform can also be easily performed using the limit line and PASS/FAIL functions which allow upper and lower limits to be set on the screen.

Using the user-define function, commonly used measurements can be easily assigned to function keys, allowing a user-created custom, easy-to-use menu.

THE LIGHTEST FIELD ANALYZERS IN THEIR CLASS
These analyzers are light and compact – 15 lbs. base unit, under 20 lbs. with battery. The easy-to-attach strap allows the analyzer to be carried on the shoulder for transport or during measurements. The rugged construction meets MIL-T-28800 and stands up to the harsh conditions of field use.

THREE POWER SOURCES TO CHOOSE FROM
The U3641/U3641/N can operate not only on 100/200 V AC power, but also on +10 to +16 V DC or the optional battery pack. Choose the power source that matches your need for portable flexibility.

LARGE COLOR TFT LCD DISPLAY
The 6 in. color TFT LCD display enhances viewing of complex measurements. A built-in tilt mechanism allows adjusting the viewing angle ±15 degrees to improve visibility and efficiency.

COMPUTER AND INTERFACE FRIENDLY
These analyzers are well suited for computer-based applications. Two PCMCIA memory card slots allow you to store and recall instrument settings and measurements. This data can also be transferred directly to a computer in CSV (comma separated variable) format. The memory card slots incorporate a dust-proof shutter and an eject mechanism for reliable operation even in difficult outdoor working conditions.

RS-232C and GPIB ports are also standard. This allows you to print hardcopies of spectrum information and to control the instruments from and external computer as well as send/retrieve data.

Composite video out jacks are standard. The output of these spectrum analyzers can be easily projected for better viewing in meetings or training sessions.

Characteristics

FREQUENCY RELATED
Frequency Range –
U3641: 9 kHz to 3 GHz.
U4941/U4342: 9 kHz to 2.2 GHz.

Frequency Readout Accuracy – (Start, Stop, CF, Marker)
U3641/N: ±(marker frequency x frequency reference error + 5% x span + 15% x RBW + 10 Hz).
U4941/N/U4342: ±(span x span accuracy + 0.15 x RBW + 50 kHz).

Count Frequency Marker –
Resolution:
U3641/N: 1 Hz to 1 kHz.
U4941/N/U4342: 1 Hz to 1 kHz.
Count Accuracy:
U3641/N (S/N ≥25 dB, RBW ≥3 kHz, 1 kHz ≤ SPAN ≤200 MHz): ±(marker frequency x frequency reference accuracy + 1 LSD ± 5 Hz).
U4941/N/U4342: (S/N ≥ 25 dB, 50 kHz ≤ span ≤ 10 MHz, RBW ≥ 100 kHz): ±(marker frequency x frequency reference accuracy + 1 LSD ± 5 Hz).

Frequency Reference Accuracy – ±2 x 10^{-6}/year ±1 x 10^{-5} (at 0° C to 50 ° C).

Frequency Span –
Range:
U3641/N: 1 kHz to 3.2 GHz, 0 Hz (Zero Span).
U4941/U4342/N: 1 kHz to 2.4 GHz,(Zero Span).
Accuracy:
U3641/N: ≤±5% (SPAN).
U4941/U4342/N: ≤±5% (SPAN ≥ 100 kHz).

Frequency Stability –
U3641/N:
Residual FM: ≤60 Hzp-p/100 ms (ZERO span).
Frequency Drift: <150 Hz/min (SPAN ≤10 kHz).

Frequency Stability -
U4941/4342/N:
Residual FM: ≤3 kHz p-p/100 ms.
Frequency Drift (50 ms to 5 s sweep time): <10 kHz after 30 min. warm-up.

Noise Sidebands –
U3641/N:
20 kHz Offset: ≤–105 dBc.
10 kHz Offset: ≤–100 dBc.
U4941/4342/N: ≤–100 dBc/Hz at 20 kHz offset.

Resolution Bandwidth (3 dB) –
Range: 1 kHz to 3 MHz, 1-3 sequence.
U3641, Opt. for 100, 300 Hz.
Bandwidth Accuracy:
1 kHz to 1 MHz: ≤±20%.
3 MHz: ≤±25%.
Selectivity: <15:1 (60 dB to 3 dB, RBW 1 kHz to 3 MHz).

Bandwidth (6 dB) (U4941/N): 9 kHz, 120 kHz (conforming to CISPR standard).

Video Bandwidth – 10 Hz to 3 MHz (1-3 step).

AMPLITUDE RELATED
Amplitude Range –
U3641: +20 dBm to displayed Average Noise Level.
U3641N: +130 dBµV to displayed Average Noise Level.
U4941/N: +20 dBm to displayed Average Noise Level: +130 dBµV to displayed Average Noise Level.

Maximum Input Level (±50 V DC maximum) –
Preamplifier OFF (Input Atten ≥10 dB):
U3641: +27 dBm.
U3641N: +134 dBµV.
U4941/N: +27 dBm, +134 dBµV.
Preamplifier ON (input atten ≥10 dB):
U3641: +13 dBm.
U3641N: +120 dBµV.
U4941/N: +13 dBm, +120 dBµV.

Display Range –
Log: 10 x 10 div, 10, 5, 2, 1 dB/div.
Linear: 10% of reference level/div, RBW ≥3 kHz.
QP Log (U4941/N): 40 dB (5 dB/div).

Reference Level Range (U3641/N) –
Preamplifier OFF (Input Atten 0 dB to 50 dB):
Log: U3641, –64 dBm to +40 dBm; U3641N, +46 dBµV to +150 dBµV.
Linear: U3641, +141.1 µV to +22.36 V; U3641N, +198.4 µV to 31.44 V.
Preamplifier ON (Input Atten 0 dB to 10 dB):
Log: U3641, –89 dBm to –25 dBm (0.1 dB step); U3641N, +21 dBµV to +85 dBµV.
Linear: U3641, +7.934 µV to +12.57 mV; U3641N, +11.16 µV to 17.68 mV.

Reference Level Range (U4941/U4342/N) –
Preamplifier OFF: Log, –64 dBm to +40 dBm (0.1 step); +46 dBµV to +150 dBµV
Linear, +141.1 µV to +22.36 V; 199.5 µV to 31.62 V.
Preamplifier ON: Log, –84 dBm to +10 dBm (0.1 dB step); +26 dBµV to +120 dBµV.
Linear, 14.11 µV to 707.1 mV, 19.95 µV to 1 V.

Input Attenuator Range – 0 to 50 dB (10 dB step).

Spectrum Analyzers
New U3641/N • New U4342 • U4941/N

SWEEP RELATED
Sweep Time –
U3641/N: 50 µs to 1000 s and manual sweep.
U4941/4342/N: 50 ms to 1000 s and manual sweep.

Accuracy – ≤±5%.

Trigger Mode – Free Run, Single, Video, Ext, TV.

DEMODULATION
Spectrum Demodulation –
Modulation Type: AM and FM (FM at RBW ≥ 3 kHz).
Audio Output: Speaker and phone jack with volume control.

DYNAMIC RANGE
Displayed Average Noise Level (RBW 1 kHz, VBW 10 Hz) –
Preamplifier OFF:
U3641: –117 dBm + 2.7 f (GHz) dB.
U3641/N: –8 dBµV + 2.7 f (GHz) dB.
U4941/N: –117 dBm + 2.7 f (GHz) dB; –8 dBµV + 2.7 f (GHz) dB.
Preamplifier ON:
U3641: –135 dBm + 4.3 f (GHz) dB.
U3641/N: –26 dBµV + 4.3 f (GHz) dB.
U4941/N: –132 dBm + 3.3 f (GHz) dB; –23 dBµV + 3.3 f (GHz) dB.

Gain Compression (1 dB) –
Preamplifier OFF (mixer input level, f ≥10 MHz):
U3641: >–10 dBm.
U3641/N: >+100 dBµV.
U4941/N: >–10 dBm (mixer input level, f ≥10 MHz); >+100 dBµV.
Preamplifier ON (RF input level, f ≥10 MHz):
U3641 (ATT = 0): >–40 dBm.
U3641/N: >+70 dBµV.
U4941/N: >–40 dBm (RF input level, f ≥10 MHz): >+70 dBµV.

Spurious Response (Input Atten 0 dB, f ≥10 MHz) –
Preamplifier OFF:
Second Harmonic Distortion:
U3641: ≤–70 dB (–30 dBm input).
U3641/N: ≤–70 dB (+78 dBµV input).
U4941/N: ≤–70 dB (–30 dBm input).
Third Order Intermodulation Distortion:
U3641: ≤–70 dB (–30 dBm input).
U3641/N: ≤–70 dB (+78 dBµV input).
U4941/N: ≤–70 dB (–30 dBm input).

Residual Responses (Input Atten 0 dB, f ≥10 MHz) –
Preamplifier OFF:
U3641: ≤–100 dBm, 50 Ω.
U3641/N: ≤+10 dBµV, 75 Ω.
U4941/N: ≤–100 dBm; ≤+10 dBµV.
Preamplifier ON:
U3641: ≤–105 dBm, 50 Ω.
U3641/N: ≤+5 dBµV, 75 Ω.
U4941/N: ≤–115 dBm; ≤–5 dBµV.

AMPLITUDE ACCURACY
Frequency Response (Input Atten 10 dB, 20° C to 30° C, referenced to 30 MHz, after calibration) –
Preamplifier OFF:
U3641: ≤±1 dB (100 kHz to 2.7 GHz); ≤2 dB (9 kHz to 3.0 GHz).
U3641/N: ≤±1 dB (100 kHz to 2.7 GHz).
U4941/N: ≤±1 dB (100 kHz to 2.0 GHz); ≤2 dB (9 kHz to 2.2 GHz).
Preamplifier ON:
U4342: ≤±1 dB (100 kHz to 2.7 GHz).
U3641: ≤±2 dB (9 kHz to 3.0 GHz).
U3641/N: ≤±1 dB (100 kHz to 2.2 GHz).
U4941/N: ≤±1 dB (100 kHz to 2 GHz); ≤2 dB (9 kHz to 2.2 GHz).

Calibration Signal Accuracy –
U3641: –20 dBm ±0.3 dB.
U3641/N: +90.5 dBµV ±0.3 dB.
U4941/N: –20 dBm ±0.3 dB; + 90.5 dBµV ±0.3 dB.

IF Gain Uncertainty (after automatic calibration) –
≤±0.5 dB.

Scale Fidelity (after automatic calibration) –
Log: ≤±1.5 dB/90 dB; ≤±1 dB/10 dB; ≤±0.2 dB/1 dB.
Linear: ≤±5% of reference level, RBW 3 kHz.

Input Attenuator Switching Accuracy (10 dB reference, 20 dB to 50 dB setting) –
U3641:
100 kHz to 2.7 GHz: ≤±1.0 dB.
9 kHz to 3.0 GHz: ≤±1.5 dB.
U3641/N:
100 kHz to 2.2 GHz: ≤±1.0 dB.
U4941/N:
100 kHz to 2 GHz: ≤±1.0 dB.
9 kHz to 2.2 GHz: ≤±1.5 dB.

Resolution Bandwidth Switching Uncertainty (after automatic calibration) –
≤ ± 1.0 dB at RBW 3 MHz.

INPUTS AND OUTPUTS
RF Input –
Connector: N-type jack.
Impedance:
U3641/U4941/U4342: 50 Ω (nominal).
U3641/N/U4941/N/U4342/N: 75 Ω (nominal).
VSWR:
Preamplifier OFF:
100 kHz to 2 GHz: ≤1.5:1.
9 kHz to 3.0 GHz (2.2 GHz U3641/N/U4941/U4941/N): ≤2:1.
Preamplifier ON:
10 MHz to 3.0 GHz (2.2 GHz U3641/N): ≤2.5:1.
10 MHz to 2.0 GHz (U4941/N): ≤2:1.

10 MHz Reference Input –
Connector: BNC jack, rear panel.
U3641/N/U4342:
Impedance: 50 Ω (nominal).
Input Range: 0 dBm to +16 dBm.
U4941/N:
Impedance: 50 Ω (nominal).
Input Range: +8 dBm to +16 dBm.

Video Output –
Connector: BNC jack, rear panel.
Impedance: 75 Ω (nominal), AC coupled.
Amplitude: Approx. 1 Vp-p, 75 Ω (composite video signal).

External Trigger Input –
Connector: BNC jack, rear panel.
Impedance 10 kΩ (nominal), DC coupled.
Trigger Level: TTL level.

Gate Input –
Connector: BNC jack, rear panel.
Impedance: 10 kΩ (nominal).
Sweep Step: During TTL low level.
Sweep Continue: During TTL high level.

Phone Output –
Connector: Subminiature monophonic jack, front panel.
Power Output: 0.2 W into 8 Ω (nominal).

GPIB Interface –
Connector: IEEE-488 bus.
Plotter: HP-GL commands (682-XA).
Printer: PCL commands.

RS-232 –
Connector: D-SUB 9-Pin, rear panel.

Memory Card – Two memory card slots, JEIDA-Ver.4.1, PCMCIA Rel. 2.0, Type 1.

HIGH STABILITY REFERENCE SOURCE (OPT. 20 ONLY, U3641/N)
Frequency – 10 MHz.

Frequency Accuracy –
$\pm 2 \times 10^{-8}$/day.
$\pm 1 \times 10^{-7}$/year.

PHS-ID DEMODULATOR FUNCTION (OPT. 70 ONLY, U3641)
Opt. 20 and Opt. 70 cannot be installed simultaneously.

Signal Reception –
Radio Access Format – TDMA-TDD.
Modulation Format: π/4 DQPSK.
Transmission Speed: 384 Kbits/s
Signal Channel: Logic control channel code configuration conforms to RCR STD-28.

Spectrum Analyzers
New U3641/N • New U4342 • U4941/N

Level Measurement Range –
Reception Performance:
Preamplifier OFF (Input Atten = 10 dB):
52 dBµV to 107 dBµV.
Preamplifier ON (Input Atten = 0 dB):
16 dBµV to 67 dBµV.
Sweep Trigger Modes: Free Run, Video, ID.

Measurement Functions –
ID List Displays: CI, CS-ID, PS-ID, level, time.
ID-MKR: Display of specified signal ID.
Period Measurement: Measurement of specified CS-ID.

Burst Error Rate – The number of error slots/The measured (Set) number.

Level Measurement Operations –
Center value processing.
Average value processing.
Max.min. value processing.

TV DEMODULATION FUNCTION (OPT. 72 ONLY) U3641/N
TV Demodulation –
Demodulation Type: NTSC, PAL, SECAM.
TV Standard: M, B/G, D/K/K', I, L/L'.
Output: Video, sound.

TV Image Demodulation Output –
Connector: BNC jack, rear panel.
Impedance: 75 Ω (nominal), DC coupled.
Amplitude: Approx. 1 $V_{p\text{-}p}$, 75 Ω.

TV Sound Demodulation Output –
Connector: Pin jack, rear panel.
Impedance: 1 kΩ (nominal), AC coupled.

TV Image Signal Input –
Connector: BNC jack, rear panel.
Impedance: 75 Ω (nominal), AC coupled.
Input Level: About 1 $V_{p\text{-}p}$.

TV Sound Signal Input –
Connector: Pin jack, rear panel.
Impedance: 1 kΩ (nominal), AC coupled.

TRACKING GENERATOR FUNCTION
Opt for U3641/N. STD for U4342.

Frequency Range – 100 kHz to 2.2 GHz.

Output Level Range –
0 dBm to –31 dBm, 1 dB steps.
N Version: 105 dBµV to 74 dBµV, 1 dB steps.

Output Level Accuracy –
(at 30 MHz, –10 dBm: ≤0.5 dB.
N Version (at 30 MHz, 95 dBµV: ≤0.5 dB.

Output Level Flatness –
(at –10 dBm, 30 MHz reference):
100 kHz to 1 GHz: ≤±0.7 dB.
100 kHz to 2.2 GHz: ≤±1.5 dB.
N Version (at 95 dBµV, 30 MHz reference):
100 kHz to 1 GHz: ≤±0.7 dB.
100 kHz to 2.2 GHz: ≤±1.5 dB.

Output Level Switching Accuracy –
(at –10 dBm reference):
100 kHz to 1 GHz: ≤±1.0 dB.
100 kHz to 2.2 GHz: ≤±2.0 dB.
N Version (at 95 dBµV reference):
100 kHz to 1 GHz: ≤±1.0 dB.
100 kHz to 2.2 GHz: ≤±2.0 dB.

Output Spurious –
Harmonic: <–20 dBc.
Non-harmonic: <–30 dBc.

Tracking Generator Leakage –
≤–95 dBm.
N Version: ≤–16 dBµV.

Tracking Generator Output –
Connector: N-type jack.
Impedance:
50 Ω (nominal).
N Version: 75 Ω (nominal).
VSWR:
(≤–10 dBm output): ≤1.5.
N Version (≤–10 dBµV output): ≤2.0.

CHANNEL INPUT SETTING (OPT. 78 ONLY, U3641/N)
(Opt. 78 is included in Opt. 72.)

Channel Setting – Channel setting for VHF, UHF, CATV, BS, and CS. Two user tables are available and 99 channels can be registered for each table.

ENVIRONMENTAL
Temperature –
Operating: 0° C to 50° C.
Non-operating: –20° C to +60° C.

Humidity – 85% or less.

POWER REQUIREMENTS
External DC Input –
Connector: XLR 4-Pin.
Voltage Range: +10 V to +16 V.
Power Consumption: 60 W maximum.

AC Input –
Line Voltage: 100 VAC and 200 VAC, auto switching.
Voltage Range:
100 V Operation: 90 V to 120 V.
220 V Operation: 220 V to 240 V.
Line Frequency: 50 Hz/60 Hz.
Power Consumption: 100 VA maximum.

PHYSICAL CHARACTERISTICS

Dimensions (without feet or connectors)

	mm	in.
Height	148	5.75
Width	291	11.375
Depth	330	13.25

Weight (without options, accessories, carrying belt, batteries)

	kg	lbs.
U3641/N/U4342	6.9	15.2
U4941/N	6.5	14.3

Spectrum Analyzers

New U3641/N • New U4342 • U4941/N

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

U3641
Portable Spectrum Analyzer, 50 Ω Input.

U3641N
Portable Spectrum Analyzer, 75 Ω Input.
Includes: Power Cable (A01402), N-to-BNC Adapter (U3641 – JUG-201A/U), NC-to-BNC Adapter (U3641N – BA-A165), N-C15 Adapter (U3641N – (NCP-NFJK), AC-DC Adaptor (A08364), Carrying Strap, Operation Manual, SRAM card.

U4342
RF Field Analyzer with Tracking Generator, 50 Ω Input.

U4342/N
RF Field analyzer with Tracking Generator, 75 Ω Input.
Includes: Power Cable (A01402), N-to-BNC Adapter (U4342 – JUG-201A/U), NC-to-BNC Adapter (U4342/N – BA-A165), N-C15 Adapter (U4342/N – (NCP-NFJK), AC-DC Adaptor (A08364), Carrying Strap, Operation Manual, SRAM card.

U4941
RF Field Analyzer, 50 Ω Input.

U4941/N
RF Field Analyzer, 75 Ω Input.
Includes: N-to-BNC Adapter (JUG-201A/U), AC-DC Adaptor (A08364), Carrying Strap, Instruction Manual, Quick Guide, SRAM card.

U3641/U3641/N OPTIONS

Opt. 15 – Program controller.

Opt. 20 – High-stability reference (cannot be installed with Opt. 70).

Opt. 26 – Narrow RBW filters (300/100 Hz).

Opt. 70 (U3641 only) – PHS demodulation (cannot be installed with Opt. 20 or Opt. 72).

Opt. 72 – TV demodulation (cannot be installed with Opt. 70, includes Opt. 78).

Opt. 74 – Tracking generator.

Opt. 78 – Channel input setting (included with Opt. 72).

MEASUREMENT SERVICE OPTIONS
U3641/N, U4342/N, U4941/N

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES

Battery – Order 146-0111-00 (Requires Charger).

Battery Charger – Order 119-4901-00.

External DC Power Cable – Order A01434.

Memory Card, 64K – Order A09507.

Soft Carrying Case – Order R16216.

Transit Case – Order R16072.

Front Panel Cover – Order A02806.

Carrying Handle – Order A08104.

Display Hood – Order R16601.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Spectrum Analyzers
2712 • 2711

Features

2712

- High Value, Low Cost
- 5 x 10^{-7} Frequency Accuracy
- Sensitivity to –139 dBm (–92 dBmV) with Built-in Preamp
- Internal Frequency Counter
- 4 Trace Digital Plus True Analog Display
- 124 K of RAM
- Easy to Use
- Dedicated Numeric Keypad Plus Logically Grouped Menu Keys
- Powerful Built-in Measurement Routines
- EMC Measurements with Optional Quasi-peak Detector
- Swept Measurements to 1.8 GHz with Optional Internal or External Tracking Generator
- UL Listed 1244, Certified CSA C22.2 No. 231-M89

2711

- Economical, Can Be Configured to Meet Most Budgets
- High Portability
- Internal or External Tracking Generator Option
- Internal Frequency Counter (Option 02)
- GPIB or RS-232 Interface Option
- Excellent Frequency Accuracy and Sensitivity
- 3-Control Operation for Most Measurements
- UL Listed 1244, CSA Bulletin 556B

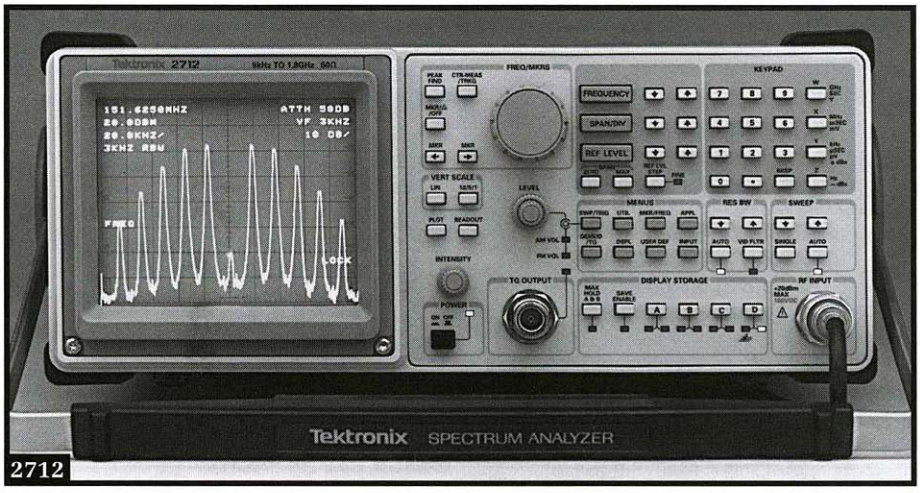
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *2712, 2711 Option 03 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*



2712 Spectrum Analyzer

The Tektronix 2712 Spectrum Analyzer provides excellent RF performance, a built-in frequency counter, full programmability, digital and true analog displays, high portability, enough non-volatile memory for 108 saved displays, and much more.

A straightforward human interface, with conveniently-grouped, dedicated front-panel keys and simple, menu-driven functions makes the 2712 easy to learn and use. You can set frequency, span, and reference level directly from the front panel. A real-time clock provides an on-screen date and time display, plus date/time stamp capability for waveform printouts.

Frequency-corrected tuning and phaselock stabilization enhance the ability to resolve close-in signals and reliably demodulate narrowband signals. Sensitivity up to –127 dBm (–80 dBmV) at 300 Hz resolution bandwidth (RBW) lets you see weak signals. The built-in preamp can improve sensitivity another 12 dB, up to –139 dBm (–92 dBmV). Up to 80 dB on-screen dynamic range ensures visibility of weak signals in the presence of strong ones.

A 300 Hz RBW filter with a shape factor ≤7:1 means you'll see many close-in sidebands and spurious or unexpected signals you might otherwise miss. At the other end of the spectrum the 5 MHz RBW filter is useful when demodulating wideband signals such as actively modulated video carriers.

The built-in signal counter, with 0.5 ppm ±10 Hz accuracy, offers added power for rapidly identifying signals. The capability to choose between digital and true analog displays lets you examine signals for characteristics that are not visible on digital-only displays.

Sweep speeds of 1 µsec/div, TV Line and TV Field triggering, an internal audio amplifier and AM/FM detectors, and the optional Video Monitor Mode all make video communications measurements easier.

Bandwidth, Carrier-to-Noise, Noise Power, Signal Search, and FM Deviation modes provide additional measurement power and convenience. Occupied Bandwidth Mode, with percent settable from 1 to 99%, aids in broadcast and radio measurements.

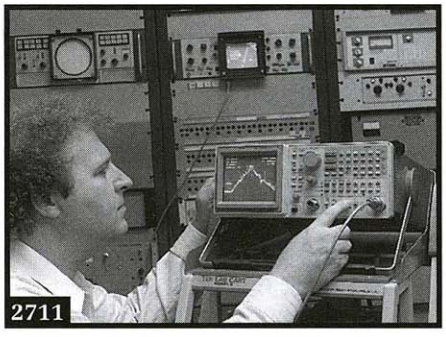
The optional internal or external tracking generator provides high dynamic range swept measurements to 1.8 GHz.

EMC MEASUREMENT

To help simplify your EMC measurements, the 2712 offers an optional quasi-peak detector, EMI resolution bandwidth filters, and fully corrected E-field intensity measurements to assist in pre-certification and troubleshooting. EMC ancillary devices are available to provide a complete measurement solution. See page 207.

Continued on next page.

Spectrum Analyzers
2712 • 2711



2711 Spectrum Analyzer

The 2711 offers a wide range of features at an extremely affordable price. This value leader is well suited for checking broadcast transmitter performance and communications system operations, looking for unwanted RF emissions, testing two-way communications equipment, maintaining industrial security, and teaching frequency domain concepts in the classroom, plus a wide variety of other applications.

The standard 2711 shares many of the 2712's valuable features, such as compact size and light weight (9.5 kg, about 21 lbs.). Both instruments can also be quickly converted to rack operation with optional rack-mount adapters.

Frequency accuracy is 1 x 10^{-5} and sensitivity is up to –117 dBm (–70 dBmV) at 3 kHz RBW. The built-in preamp can add another 12 dB, up to –129 dBm (–82 dBmV). Up to 80 dB on-screen dynamic range helps see weak signals, even when strong ones are present.

True analog display capability, along with fast sweep speeds and TV Line and TV Field triggering provide convenient demodulation of video carriers for making depth-of-modulation checks or looking at special baseband data, VITS, and many other signals.

An internal audio amplifier and AM/FM detectors let you hear demodulated signals, using either the built-in speaker or headphone jack, for fast signal identification and troubleshooting in communications applications.

With the Video Monitor (Option 10) installed, you can view broadcast (AM) TV signals or down-converted satellite (FM) signals.

The 2711 can also be used with a set of near-field probes as a handy EMC diagnostic tool.

SELECTION GUIDE

Capability	2712	2711
Frequency Range	9 kHz to 1.8 GHz	9 kHz to 1.8 GHz
±0.5 ppm Freq. Accuracy	Std.	NA
Signal Counter	Std.	Opt. 02
GPIB Interface	Std.	Opt. 03
Internal Tracking Gen.	Opt. 04	Opt. 04
External Tracking Gen.	Opt. 05	Opt. 05
RS-232C Interface (replaces GPIB)	Opt. 08 (no charge)	Opt. 08
Video Monitor Mode	Opt. 10	Opt. 10
EMC Pre-certification Measurements	Opt. 12	NA
TV Sideband Adapter Interface	Opt. 15	Opt. 15
Non-volatile Memory	124 K	28 K (124 K with Opt. 03 or 08)
High Portability	Yes	Yes
Both Digital and True Analog Displays	Yes	Yes
Dedicated Numeric Keypad	Yes	Yes
Real-Time Clock	Std.	With Opt. 03 or 08

Characteristics

The following characteristics apply to both the 2712 and 2711 after a 15-minute warm-up period, unless otherwise noted.

FREQUENCY RELATED

Frequency Range – 9 kHz to 1800 MHz.

Center Frequency Accuracy – 2712: 5x10^{-7} of CF ±700 Hz; 2711: 1x10^{-5} of CF ±5 kHz.

Frequency Counter Accuracy (Std. 2712, Option 02 2711) – 2712: 5x10^{-7} of CF ±10 Hz, ±1 LSB. 2711: 1x10^{-5} of CF ±10 Hz, ±1 LSB.

Dot Marker Frequency Accuracy*1 – CF Accuracy ±3% of span.

Long-term Drift*1 – 2712: 2 ppm/yr.; 2711: 10 ppm/yr.

Short-term Drift – 2712: ≤400 Hz maximum drift between correction cycles; 2711: ≤20 kHz maximum drift between correction cycles.

Residual FM – 2712: ≤100 Hz p-p/20 msec at ≤20 kHz span/div; ≤2 kHz p-p/20 msec at >20 kHz span/div; 2711: ≤2 kHz p-p/20 msec.

Resolution Bandwidth (–6 dB) – 2712: 5 MHz, 300 kHz, 30 kHz, 3 kHz, 300 Hz; 2711: 5 MHz, 300 kHz, 30 kHz, 3 kHz; 2712 with Option 14: Add 1 MHz, 100 kHz, 10 kHz, and 1 kHz; 2712 with Option 12: add 1 MHz, 120 kHz, 9 kHz, 1 kHz – 200 Hz replaces 300 Hz filter.

Resolution Bandwidth Shape Factor (60 dB/6 dB) – ≤7:1 for RBW ≤1 MHz.

Noise Sidebands – ≤70 dBc at 30xRBW.

Video Filter – Approx. 1/100 (Auto) of RBW. Manual Selection: 3 Hz to 300 kHz in 1-3 sequence.

Freq. Span/Div Range – 2712: 180 MHz to 1 kHz. 2711: 180 MHz to 10 kHz selected in 1-2-5 sequence or within two significant digits via menu.

Span Accuracy – ±3% over the center eight divisions.

AMPLITUDE RELATED

Flatness – ±1.5 dB measured with 10 dB internal RF attenuation (preamp off).

Vertical Display Modes – 10, 5, 1 dB/div, Linear.

Measurement Range – 2712: –139 (preamp on) to +20 dBm (–92 to +67 dBmV); 2711: –129 (preamp on) to +20 dBm (–82 to +67 dBmV).

Display Dynamic Range – 80 dB max (limited to 40 dB in optional 2712 Quasi-peak Detector mode).

Reference Level Range – LOG Mode: –70 to +20 dBm (–23 to +67 dBmV), or to –90 dBm with preamp on. LINEAR Mode: 8.8 µV to 280 mV.

Reference Level Steps – LOG Mode: 1 dB or 10 dB. LINEAR Mode: 1-2-5 sequence.

Mixer Input Level – Automatically controlled by instrument for on-screen signals. Level selectable between –20 to –50 dBm (+27 to –3 dBmV).

Display Amplitude Accuracy – 10 dB/div: ±1.0 dB/10 dB to max. cum. error of ±2 dB over 70 dB range; ±2.0 dB/10 dB over 70-80 dB range. 5 dB/div: ±1.0 dB/10 dB to max. cum. error of ±2 dB over 40 dB range; 1 dB/div: 1 dB max. error over 8 dB range. Linear Mode: ±5% of full scale.

RF Attenuation Range – 0 to 50 dB, 2 dB steps.

Sensitivity – 2712: –127 dBm (–80 dBmV) at 300 Hz RBW, –139 dBm (–92 dBmV) at 300 Hz RBW with preamp on (to 600 MHz); 2711: –117 dBm (–70 dBmV) at 3 kHz RBW, –129 dBm (–82 dBmV) at 3 kHz RBW with preamp on (to 600 MHz).

**1 Typical but non warrented performance parameters.*

Spectrum Analyzers
2712 • 2711

SPURIOUS RESPONSE (PREAMP OFF)

Residual Spurious Response – ≤–100 dBm referenced to input of 1st mixer.

3rd Order IM Distortion – ≤–70 dBc, from any two on-screen signals within any frequency span measured with 1st mixer input level of ≤–30 dBm (+17 dBmV).

2nd Harmonic Distortion – ≤–66 dBc measured with 1st mixer input level of ≤–40 dBm (+7 dBmV).

INPUT RELATED

LO Emission – ≤–70 dBm with 0 dB RF attenuation.

RF Input – Type N connector, 50 Ω.

VSWR with 10 dB or More RF Attenuation – 1.5:1 max.

Maximum Safe Input – +20 dBm (+67 dBmV) (0.1 W) continuous peak with 0 dB RF attenuation; 100 V DC (initially applied with full attenuation).

1 dB Compression Point – ≥–15 dBm (+32 dBmV) with 0 dB RF attenuation.

SWEEP RELATED

Sweep Times – 1 µsec to 2 sec/div in 1-2-5 seq. (7-decade range); AUTO SWEEP mode; MANUAL SWEEP select.

Sweep Time Accuracy – ±10% over the center eight divisions.

Trigger – Free run, internal, external, line, TV field, TV line, single sweep, manual scan.

Trigger Amplitude – Internal: One division or more of signal. External: Min. 1.0 V peak, (15 Hz to 1 MHz).

INPUT/OUTPUT CHARACTERISTICS

External Trigger*1 – BNC connector, 10 kΩ impedance, DC coupled 0.1 µs min. pulse width. 35 V max.

External Video Input*1 – DC coupled. 0-50 kHz, 0-1.4 V (175 mV/div typical) signal input for vertical deflection of CRT beam.

Sweep Gate Out – TTL level, HI while CRT beam sweeps.

Sweep Output – +1.3 to –1.3 V, negative-going ramp, proportional to the horizontal sweep. Source impedance ≤50 Ω.

Video Output – 0 to +1.6 V of video signal, proportional to vertical display amplitude. 0 V is top of screen. 1 kΩ impedance.

ENVIRONMENTAL SPECIFICATIONS

Temperature – Operating: 0° to 50°C (MIL-T-28800D). Nonoperating: –55° to +75°C.

Humidity – Nonoperating: Five cycles (120 hours) per MIL-T-28800D, Class 5.

Shock – Operating and Nonoperating: Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks.

Electromagnetic Compatibility – EC92 EMC Directive 89/336/EEC:

Emissions: EN50081-I.
Radiated Emissions, 30 MHz to 1 GHz, EN55022 Class B (CISPR 22 B).
Conducted Emissions, 150 kHz to 30 MHz, EN55022 Class B (CISPR 22 B).
Conducted Emissions, power line harmonics. 0 to 2 kHz, IEC 555-213.

Immunity: EN50082-1.
Electrostatic Discharge, 8 kV, IEC 801-2.
Radiated Immunity, 27 MHz to 500 MHz, IEC 801-3. No response above –90 dBm in a 3 V/meter field.
Fast Transients, capacitive clamp, 1 kV power leads, 500 V control leads, IEC 801-4.
Power Line Surge, 1 kV differential mode, 2 kV Common mode, IEC 801-5.

Vibration – Meets MIL-T-28800E, Paragraph 4.5.5.3.1 (modified).

GENERAL CHARACTERISTICS

Power Requirements – 105 W max. (1.4 A) at 115 V, 60 Hz. Operates 48 Hz to 440 Hz, 90 to 132 V AC, or 48 Hz to 63 Hz to 250 V AC. Battery power (Option 07) available.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	137*1	5.4*1
Width	361*1	14.2*1
Depth	445*1	17.5*1
Weight	**kg**	**lbs.**
Net	9.5*2	<21*2

*1 *With feet, handle, and front panel cover.*

*2 *Nominal for basic configuration.*

OTHER CAPABILITIES

Markers – Single marker/delta marker; next right, next left peaks; next lower, next higher peaks; (highest) peak find; marker to center frequency and reference level.

Non-volatile Memory – Lithium battery backup. 2712: 124 kB available; up to 108 displays saved; 36 front-panel setups, large user-definable key routines, and antenna tables (exact number and size depends on NV RAM utilization). 2711: 28 kB available; up to 18*2 displays saved and 9*2 front-panel setups, user-definable key routines, and antenna tables.

Digital Storage Display – Selectable acquisition modes of positive peak only, positive/negative peak. SAVE A, B, C and active D trace; up to four traces on screen; MAX HOLD A, B; MIN HOLD A, B, C; B, C MINUS A; WATERFALL display mode; digital storage off provides analog sweep.

Ensemble Averaging – Provides weighted continuous or discrete averaging of display resulting in reduction of random noise.

Internal Preamp – Preamp can be switched in/out of circuit (flatness degrades above 600 MHz, provides approximately 12 dB sensitivity improvement).

Alternative Reference Level Units – dBm, dBmV, dBV, dBµV, dBµW, dBµV/m.

User-Definable Power-on Status – Instrument powers up to user-definable state or factory default condition.

Center Measure – Signal is centered with frequency and peak amplitude automatically read out (not a marker mode). The signal is counted in the 2712 or 2711 with Option 02.

Signal Track – Drifting signal is kept at display center with correct frequency and peak amplitude displayed.

Graticule Illumination – For CRT photography in analog display mode.

Direct Plot/Print – Supports Epson FX and LQ Series Printers via built-in GPIB interface (std. 2712, 2711 Option 03), RS-232C interface (Option 08, 2712 and 2711).

*1 *Typical but non-warranted performance parameters.*

*2 *Up to 108 saved displays, 36 front-panel setups available with Option 03 or 08.*

Spectrum Analyzers
2712 • 2711

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

2712
Spectrum Analyzer.
Includes: Power Cord (U.S. 115 V/60 Hz), User's Manual, Pocket Reference Guide, Programmers Manual, Front Cover, and N-to-BNC Adapter.

2711
Spectrum Analyzer.
Includes: Power Cord (U.S.115 V/60 Hz), User's Manual, Pocket Reference Guide, Front Cover, and N-to-BNC Adapter.

Opt. 02 – (2711 only) Add Internal Frequency Counter with Selectable 1 kHz/1 Hz Readout Resolution.

Opt. 03 – (2711 only) GPIB Interface. Full Programmability, Direct Print, additional NV RAM, and Real-time Clock. Cannot combine with Opt. 08.

Opt. 04 – Add Internal Tracking Generator, 100 kHz to 1800 MHz, 0 dBm to –48 dBm in 0.1 dB steps. (Not compatible with 2712 Opt. 12 or 14 – order External Tracking Generator Opt. 05 instead.)

Opt. 05 – External Tracking Generator with Active Probe Power Jack. Not compatible with Opt. 04.

Opt. 07 – Add 2704 Inverter/2705 Battery Pack.

Opt. 08 – (2712 only) Replace GPIB with RS-232C Interface.

Opt. 08 – (2711 only, not compatible with Opt. 03.) RS-232 Interface, Full Programmability, Direct Print, additional NV RAM, and Real-time Clock.

Opt. 10 – Video Monitor Mode.

Opt. 12 – (2712 only) Add Quasi-peak Detector (built-in). Including 200 Hz, 9 kHz, and 120 kHz EMC Filters; 1 kHz and 1 MHz RBW Filters. Not compatible with Opt. 04 or 14. Note: 200 Hz EMC Filter replaces standard 300 Hz RBW Filter.

Opt. 14 – (2712 only) Add 1 kHz, 10 kHz, 100 kHz, and 1 MHz RBW Filters.
Not compatible with Opt. 04 or 12.

Opt. 15 – 1st LO output for use with Tektronix 1405 TV Sideband Adapter Interface or 2707 Internal Tracking Generator.

Opt. 20 – EMC Antenna Set plus Tripod and Coax suitable for tests to 1 GHz (contact Tektronix sales engineer for more information).

Opt. 21 – Add 2706 Stepping RF Preselector.

Opt. 30 – Rackmount for 19 in. rack width, 5.25 in. height.

Opt. 33 – Travel Line Package. Including Accessory Pouch, Carrying Strap, Vinyl Rain Cover.

Opt. 34 – Portable-to-Rackmount Adapter for 19 in. rack width, 7 in. height.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.
See Customer Information Section for additional description.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

SOFTWARE
See page 199 for additional information.

271x PC Utility Software – Order S26UT10.

EMI Commercial Test Software – Order S26EMI2.

EMI Ancillary Devices – See page 245.

ADDITIONAL ACCESSORIES
Also see page 438.

PROBES
Active – All require 1103 Power Supply. 4 GHz, 0.4 pF/100 kΩ, 1 m. Order P6217. 750 MHz, 2 pF/1 MΩ, 1.5 m. Order P6205.
TEKPROBE® Power Supply. Order 1103.

CART – K212 Instrument Cart.

Power Splitter – 75 Ω/50 Ω BNC Output, 50 Ω BNC Input. Order 067-1232-00.

CABLES, PADS, AND ADAPTERS

50 Ω Coaxial Cable –
BNC to BNC, 5.5 in. Order 012-0214-00.
BNC to BNC, 18 in. Order 012-0076-00.
BNC to BNC, 42 in. Order 012-0057-01.

75 Ω Coaxial Cable – BNC to BNC, 42 in. Order 012-0074-00.

GPIB Cables –
0.5 m. Order 012-1282-00.
1 m. Order 012-0991-01.
2 m. Order 012-0991-00.
4 m. Order 012-0991-02.

RS-232 Modem Cables –
9-Pin Female to 25-Pin Male. Order 012-1241-00.
9-Pin Female to 9-Pin Female. Order 012-1379-00.
9-Pin Female to 25-Pin Female. Order 012-1380-00.

75 Ω to 50 Ω Minimum Loss Adapter –
With DC block, 5.7 dB loss. Order 011-0112-00.

75 Ω BNC to 50 Ω Type N Minimum Loss Attenuator – Order 131-4199-00.

75 Ω to 50 Ω Matching Attenuator –
With 11.25 dB conversion factor from dBm to dBV with DC block. Order 011-0118-00.

"F" Female to BNC Male Adapter –
Order 013-0126-00.

BNC Female to "F" Male Adapter –
Order 103-0158-00.

"N" Female to BNC Male Adapter –
Order 103-0058-00.

75 Ω to 50 Ω Matching Transformer –
0.5 dB loss. 50 kHz to 300 MHz. Order 120-1883-00.
5 MHz to 1 GHz. Order 120-1884-00.

GPIB CARDS
PC-GPIB Card – IBM PC, AT, and compatibles. Order S3FG210.

AT-GPIB Card – IBM AT Bus (High-speed Card). Order S3FG220.

MC-GPIB Card – IBM PS/2 with Microchannel Bus. Order S3FG230.

User's Manual –
2712. Order 070-8137-00.
2711. Order 070-5800-00.

Service Manual –
2712. Order 070-8130-01.
2711. Order 070-8130-01.

Front Panel Cover – Order 200-2520-00.

Transit Case – Order 016-0792-02.

Soft Side Case – Order 016-1158-01.

Rain Cover – Order 200-2500-00.

Accessory Pouch – Mounts on top. Order 016-0677-03.

Carrying Strap – Order 346-0199-00.

Viewing Hoods –
Collapsible. Order 016-0592-00.
Binocular. Order 016-0566-00.
Polarized. Order 016-0180-00.

CRT Filter – Smoke Gray. Order 337-2775-02.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *2712, 2711 Option 03 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Cable TV Spectrum Analyzer
2715

Features

IN-SERVICE RF TESTING FROM TEKTRONIX

- In-service measurements – Compatible with NTSC and PAL Systems
- Digital channel measurements – Characterize Averaged Power; Check Noise and Distortions
- Measurements at Set-top Converter Output Simplified
- Addresses All FCC Proof of Performance Measurements
- Cable TV measurements
- Carrier level, Carrier Frequency, Carrier-to-noise, Hum/LFD, and Other Key Measurements Execute Automatically From easy-to-use, On-screen Menu
- Unattended and Remote Measurement Modes
- 75 Ω Input with Quick-change F and BNC Connectors
- Enhanced Troubleshooting Power with Built-in Preamplifier, Audio and Video Demodulation – All Standard
- FM Audio Carrier Deviation and Video Depth of Modulation Adjustment Modes
- Includes Windows-compatible PC Software for Programmed Measurement Configuration, Data Collection, Measurement Results Printouts, Limits Checking, Alarming and Control of a Locally or Remotely-located 2715
- High Portability, On-board Nonvolatile Memory, Four Digital Displays for Spectral Display Storage and Comparison, Plus True Analog, Continuous Gray Scale Display for Detecting Low Level Beats and Spurs Amidst Noise and Active Video

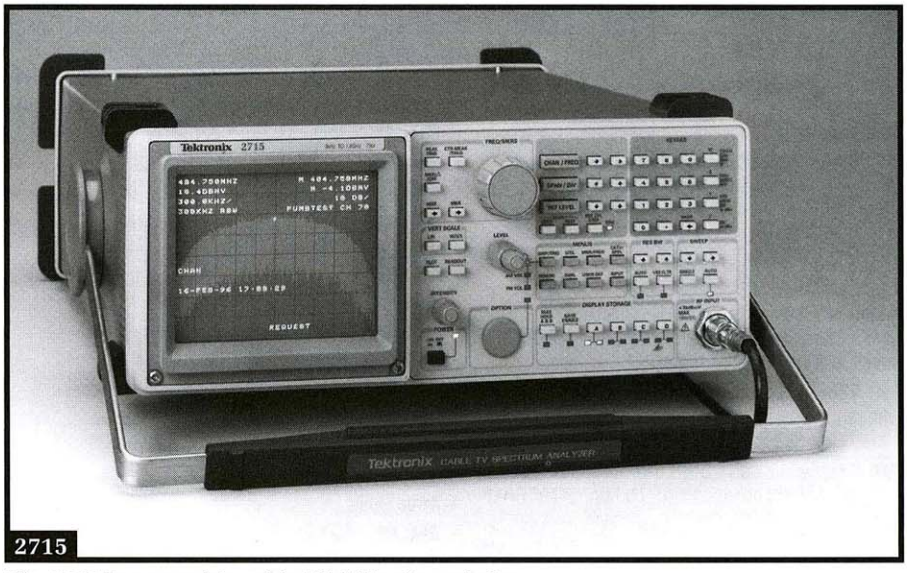
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *2712, 2711 Option 03 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*



The 2715 is a complete cable TV RF testing solution.

2715 Cable TV Spectrum Analyzer

Tektronix is a leading supplier of a broad range of innovative test solutions for emerging communications networks.

DIGITAL AND ANALOG TESTING FOR HYBRID NETWORKS

The 2715 Cable TV Spectrum Analyzer now includes automated tests for both analog and digitally-modulated channels. When you are ready to begin installing digital transmission of video, data or voice, the 2715 is ready to help. After setting up the 2715 with the new, companion Cable TV RF Measurement Software for Windows, the analyzer automatically determines the correct measurements for each channel type – analog, digital, FM or pilot.

DEPENDABLE, IN-SERVICE ANALOG CARRIER MEASUREMENTS AT AN AFFORDABLE PRICE

Now you can make more proof of performance and other cable system measurements without disruption of service to subscribers. And you can minimize the inconvenience of making measurements at the output of set-top converters. The 2715 provides accurate and automated measurement of carrier-to-noise, in-channel response, and coherent distortion signals as well as carrier levels, frequencies, and more . . . without removal of video carriers or modulation. In-service measurement of CTB requires an unoccupied channel adjacent to the test channel.

CHARACTERIZE YOUR DIGITAL CHANNELS

Channel averaged power, noise and distortions on digitally modulated channels can all be measured by the 2715. It's important to understand the performance of each of the digital channels in your system as well as their interaction with your analog channels. Both broadband random noise-like distortions, and coherent distortions – plus noise – can be measured. They all can degrade the bit-error-rate behavior of your digital signals. The 2715 includes digital channel averaged power, desired-to-undesired signal power ratio (D/U) and CTB/CSO measurement. You also can verify the spectral occupancy of your digital modulators with an adjacent channel leakage (ACL) measurement. The distortion and noise measurements require a brief removal of the digital signal.You get all this capability in a 23.5 lbs., compact, easy-to-carry package . . . at an attractive price. All of the common cable system spectral measurements are built in and menu-selectable including those needed to address field FCC proof of performance requirements. An accompanying Microsoft Windows-compatible PC software package adds measurement configuration, data collection, measurement results printouts, limits checking, alarming and more.

What used to be complicated measurement procedures, even for engineering, are now push-button simple. Technicians can easily perform extensive cable system analysis and data collection in the field, all automatically.

Cable TV Spectrum Analyzer
2715

Measurements and data collection can also be done remotely under computer control. Or the 2715 can be left unattended to run automatic measurements and data collection initiated by the built-in real-time clock. Data collected in the field can be transferred from the 2715's memory via an RS-232 or GPIB interface to a PC. The 2715's accompanying Windows PC software package includes easy transfer of data to your choice of Windows-compatible spreadsheet or data base programs for customizing analysis or reports.

QUICK, REPEATABLE, AUTOMATED MEASUREMENTS

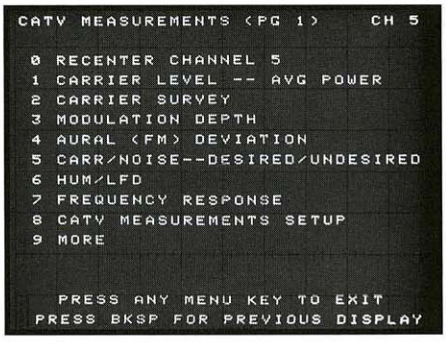
The 2715 contains the following measurements and capabilities in its cable TV (CATV/APPL) application menu:

ANALOG CHANNELS:

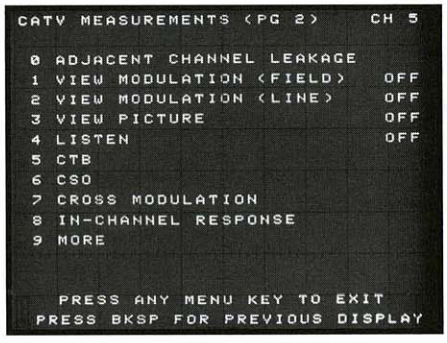
- Direct channel tuning and automatic positioning of visual and aural carriers
- Visual and aural carrier level and frequency measurement
- Survey of system visual and aural carrier levels and frequencies
- Depth of modulation adjustment and measurement
- Aural carrier FM deviation adjustment and measurement
- Visual carrier-to-noise measurement
- In-channel response measurement
- Hum/low-frequency disturbance measurement
- System frequency response
- View baseband modulation (field and line) and view picture
- Aural carrier demodulation (listen mode)
- Intermodulation distortion measurement (CTB and CSO)
- Cross modulation measurement

DIGITAL CHANNEL MEASUREMENTS:

- Averaged power
- Desired-to-undesired signal power ratio (D/U)
- Adjacent channel leakage (ACL)
- CSO and CTB
- Direct channel tuning and automatic positioning of digital signal
- Survey of system digital channel levels
- System frequency response



Pressing the CATV/APPL front panel button brings up the first page of the CATV Measurement Mode menu display.



The second page of the CATV/APPL menu appears when 9 MORE is selected on the first menu page.

Measurements selected from the menu are automatically executed, and the results are displayed on the CRT screen. Not only are complex measurements reduced to push-button simplicity for less-experienced spectrum analyzer users, but measurement repeatability is high.

Measurement results can be output to a printer or plotter connected directly to the 2715's interface port. Results can also be automatically stored in the 2715's nonvolatile memory for later transfer to a PC. This, along with high portability, makes the 2715 ideal as an automatic data collection tool in the field for engineers and technicians alike.

A battery pack option makes 2715 measurements and data collection possible even where AC power isn't available.

MORE TROUBLESHOOTING HELP...

In addition to automated measurements, the 2715 also provides analog channel video and aural carrier demodulation. Aural carrier demodulation allows you to listen to the program audio on the selected channel. Similarly, the demodulated video feature allows you to view the video on the currently selected channel (or from a down-converted satellite signal). Also, full-field or individual horizontal line waveforms can be viewed.

All of these features aid positive channel or program identification in the field. They also aid recognition of many system problems.

...AND MAINTENANCE HELP

Built-in adjustment modes for audio carrier deviation and video depth of modulation assist in day-to-day maintenance of your system. These adjustment modes are conveniently accessible from within the automated FM deviation and depth of modulation measurement routines.

CHECK FILTERS, LINE AMPLIFIERS, CABLES

The 2715's 75 Ω External Tracking Generator (Option 05) provides a convenient means of measuring frequency response on key system components. You can also sweep most two-port devices.

THE 2715 CAPITALIZES ON PC POWER

The Microsoft Windows-compatible software package that accompanies the 2715 runs automated cable TV measurements via an RS-232 or GPIB interface and collects measurement history for tracking system performance.

The software package provides the following capabilities:

Channel table generator – You can create your own channel tuning tables in addition to the standard tables provided. Creating your own custom channel tuning tables is a simple matter of editing one of the standard tables or creating a completely new table by filling in a predefined, on-screen channel-setup form. Your custom tables can then be transferred to the 2715 to be used with its built-in measurement features. Result: data will be consistently taken on all of your system carriers including scrambled channels, aeronautical offsets, and non-standard frequencies.

High-level test sequences – You can configure automatic test sequences from the 2715's built-in measurements. Creating a test sequence is a simple matter of indicating the desired tests in an on-screen setup matrix.

Your test sequences can then be transferred to the 2715 for later execution via front-panel selections, or run from a PC situated at another location. This capability allows less experienced technicians to easily execute high-level test sequences that have been defined and loaded into the 2715 by a cable TV system engineer or senior technician.

Cable TV Spectrum Analyzer
2715

Additionally, a time of day can be specified for automatic execution of any test sequence. You can also specify the number of times that a test is to be repeated and the interval of time between test repetitions. This allows you to leave the 2715 unattended while it automatically performs its time initiated test procedures and stores results. For example, you can leave the 2715 at a node site overnight or over the weekend for unattended monitoring and data collection.

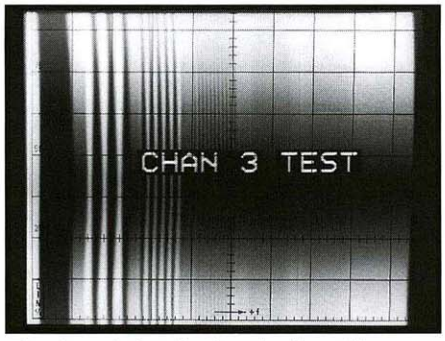
Labor-saving ancillary features – Detailed or summary current or historical measurement results can be printed directly from the 2715 PC Software or can be copied into another Microsoft Windows-compatible program for report customization.

You can execute tests from a remotely-located 2715 by using the CATV RF Measurements PC Software in conjunction with the Terminal Program that is a standard accessory of the Windows operating system software. You can place the 2715 at a node of another remote site while measurements and data collection are controlled from a centrally located PC. This configuration can significantly reduce the number of field trips necessary to monitor and diagnose system trouble spots. The RF Measurement Software also includes limits checking, alarming and 271X display transfer functions.

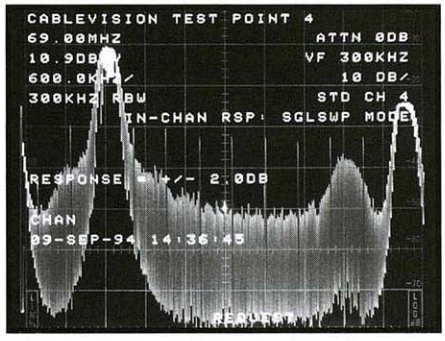
GENERAL PURPOSE CAPABILITIES

In addition to its special cable TV features, the 2715 also doubles as a highly capable, general-purpose spectrum analyzer. You get excellent RF performance, a built-in frequency counter, full programmability, enough non-volatile memory for up to 108 saved displays and 36 front-panel setups, digital and true analog displays, high portability, and numerous other features.

Access to the 2715's many capabilities is extremely easy too. The straightforward user interface provides conveniently grouped, dedicated front-panel keys and simple, menu-driven functions. This makes the 2715 very easy to learn and use. The end result is more measurement power in the hands of more people for improved system performance from cable headend to subscriber terminal.



The demodulated video display aids channel or program identification. It also aids trouble-shooting by showing gross picture anomalies, such as the hum bars displayed here.



Measurement conditions and results are clearly displayed on-screen. Text can even be added, to describe measurement location for example.

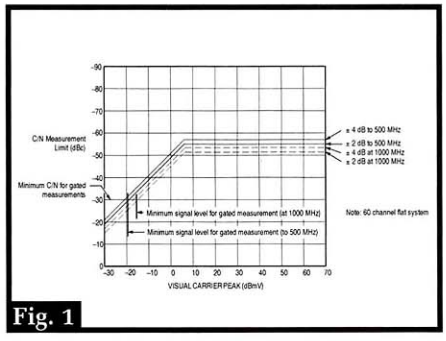


Fig. 1

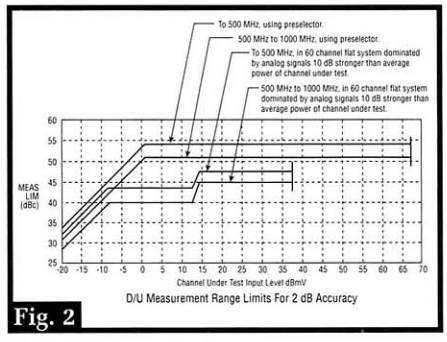


Fig. 2

Characteristics

The following specifications and features apply after a 15 minute warmup period and after all normalizations, including reference normalizations, have been performed. CATV characteristics represent typical performance and are dependent on general spectrum analyzer specifications. CATV characteristics need not be verified independently providing that all spectrum analyzer specifications are verified.

CABLE TV MEASUREMENTS

Channel Selection – Visual and aural carriers displayed when channel number is entered or front-panel selected.
Tune Configuration: STD, HRC, IRC, and custom; configured using 2715 PC software.
Channel Range: 0 to 999; configured using 2715 PC software.
Frequency Range: 1 MHz to 1.8 GHz; dependent on selected Channel Table.

Visual Carrier Frequency – Measured with internal counter to 1 Hz resolution with accuracy of $5x10^{-7}$ x Carrier Frequency ±10 Hz ±1 Least Significant Digit.

Visual-to-Aural Carrier Frequency – Aural carrier measured with internal counter relative to visual carrier.
Difference Range: 1 MHz to 10 MHz (depending on selected channel table) for an amplitude difference of ≤30 dB and aural carrier to noise ≥15 dB (300 kHz RBW).
Resolution: 1 Hz.
Accuracy: ±15 Hz for visual-to-aural carrier difference ≤8 MHz.

Visual Carrier Peak Level – Absolute peak amplitude measured with preamp off.
Amplitude Range: –18 dBmV to +58.8 dBmV for visual carrier to noise ≥30 dB (300 kHz RBW) and total input power ≤+70 dBmV.
Frequency Range: 15 MHz to 1015 MHz.
Resolution: 0.1 dB.
Absolute Accuracy: ±2.5 dB for visual carrier to noise ≥30 dB (300 kHz RBW); for FM signals, carrier to noise ≥33 dB (100 kHz RBW).
Relative Accuracy: ±0.5 dB relative to adjacent channel, ±1.2 dB relative to all others.

Cable TV Spectrum Analyzer
2715

Visual-to-Aural Carrier Level Difference – Difference Range:
0 to 30 dB for aural carrier to noise ≥ 15 dB (300 kHz RBW).
Resolution: 0.1 dB.
Accuracy: ±0.75 dB for aural carrier to noise ≥15 dB (300 kHz RBW).

Digital Channel Averaged Power – Averaged amplitude measured with preamp off.
Amplitude range: –30 dBmV to +37 dBmV (multi-channel) or –30 dBmV to +52 dBmV (preselected).
Resolution: 0.1 dB.
Absolute accuracy: ±2.5 dB.

Carrier to Noise – Default noise floor is a normalized 4 MHz bandwidth measured relative to the visual carrier peak.
Range and Accuracy: See Figure 1.
Resolution: 0.3 dB.
Gated, in-service measurement is in-band; non-gated, in-service measurement is at guard band below channel boundary.

Digital Channel Desired to Undesired Ratio – Channel averaged power is divided by total noise plus distortion power in the channel.
Range and Accuracy: See Figure 2.
Resolution: 0.3 dB.

Modulation Depth – % AM measured from sync tip to lowest white level in 10 sweeps (VITS line used if defined in channel table).
AM Range: 50% to 95%.
Resolution: 0.1%.
Accuracy: ±2% for visual carrier to noise ≥40 dB (300 kHz RBW).

Hum/Low-Frequency Disturbance – Power line frequency measured on an unmodulated visual carrier and low frequency disturbance measured on the modulated carrier.
AM Range: 1% to 10% peak-to-peak.
Resolution: 0.1%.
Accuracy: ±1% for hum ≤5% and visual carrier to noise ≥25 dB (300 kHz RBW); ±2% for hum <10% and visual carrier to noise ≥25 dB (300 kHz RBW).

Frequency Response – For fixed-amplitude scrambling or no scrambling, system amplitude variations (flatness) are displayed relative to a reference trace stored during frequency-response reference setup.
Range: 5 dB/div.
Resolution: 0.2 dB.
Flatness Accuracy: ±0.75 dB.

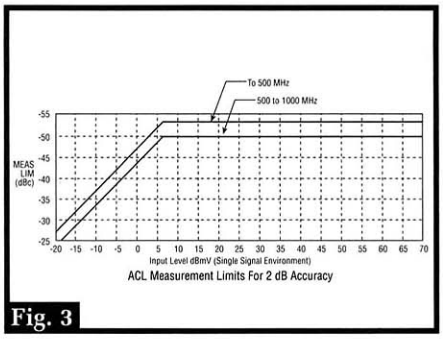


Fig. 3

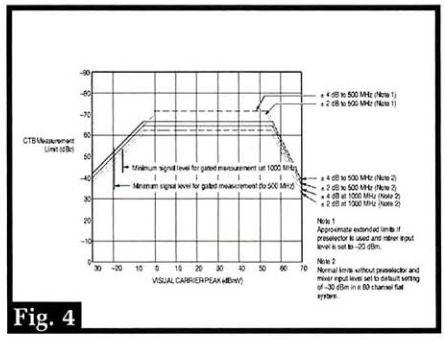


Fig. 4

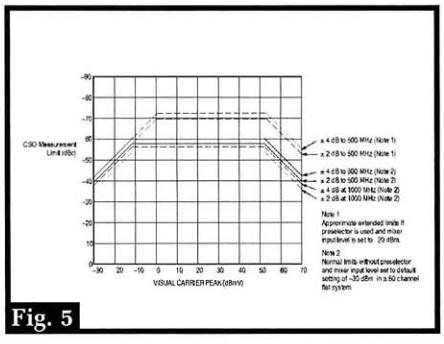


Fig. 5

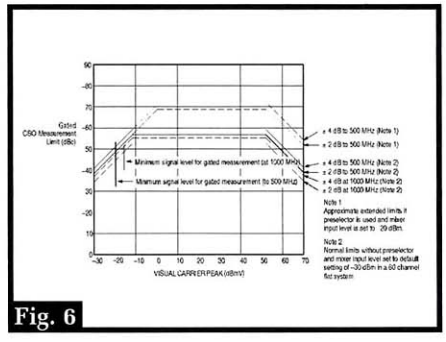


Fig. 6

In-Channel Response – Expresses maximum variance in amplitude within some specified frequency range within a particular channel, given a "flat" test signal over that same specified range. The variance is referenced to the average of the highest and lowest amplitude within the frequency range.
Range: ±3 dB.
Resolution: 0.1 dB.
Accuracy: ±0.5 dB.
Test signal line number must be specified for in-service measurements.

Digital Channel Adjacent Channel Leakage – Averaged power in adjacent channel(s) is divided by averaged power for the test channel.
Range and Accuracy: See Figure 3.
Resolution: 0.3 dB.

Carrier Survey – Absolute peak amplitude of each visual carrier is measured and each associated aural carrier level is measured relative to the visual carrier for selected channels. Frequency counted only in ACCUR FREQ/AMPL mode.

Visual Carrier (FREQ/AMPL and ACCUR AMPL modes)
Amplitude Range: –18 dBmV to +58.8 dBmV for visual carrier to noise ≥30 dB (300 kHz RBW) and total input power ≤+70 dBmV.
Frequency Range: 15 MHz to 1015 MHz.
Resolution: 0.1 dB.
Absolute Accuracy: ±2.5 dB for visual carrier to noise ≥30 dB (300 kHz RBW); for FM signals, carrier to noise ≥33 dB (100 kHz RBW).
Relative Accuracy: ±0.5 dB relative to adjacent channel, ±1.2 dB relative to all others.

Visual Carrier (FAST AMPL mode)
Amplitude Range: –18 dBmV to +58.8 dBmV for carrier to noise ≥30 dB (300 kHz RBW) and total input power ≤+70 dBmV.
Frequency Range: 15 MHz to 1015 MHz.
Resolution: 0.3 dB.
Absolute Accuracy: ±2.7 dB for carrier to noise ≥30 dB (300 kHz RBW); for FM signals, carrier to noise ≥33 dB (100 kHz RBW).
Relative Accuracy: ±0.8 dB relative to adjacent carrier; ±1.5 dB relative to all other channels.
Aural Carrier (FREQ/AMPL and ACCUR AMPL modes)
Difference Range: 0 dB to 30 dB for aural carrier to noise ≥15 dB (300 kHz RBW).
Resolution: 0.1 dB.
Accuracy: ±0.75 dB for aural carrier to noise ≥15 dB (300 kHz RBW).

Cable TV Spectrum Analyzer
2715

Aural Carrier (FAST AMPL mode)
Difference Range: 0 dB to 30 dB for carrier to noise ≥15 dB (300 kHz RBW).
Resolution: 0.3 dB.
Accuracy: ±1.1 dB for carrier to noise ≥15 dB (300 kHz RBW).

Analog Channel CTB and CSO – Measured relative to visual carrier peak according to NCTA recommendations.
Range and Accuracy for INTERACTIVE and AUTO modes: See Figures 4, 5, and 6.
Only ±4 dB curve applies to SINGLE SWEEP and CONTINUOUS modes.
Resolution: 0.3 dB.

Digital Channel CTB and CSO – Measured relative to the averaged power of the test channel.
Range and Accuracy: See Figures 7 and 8.
Resolution: 0.3 dB.

Aural (FM) Deviation – Peak FM deviation is measured for the selected channel.
Range: 10 kHz to 50 kHz; usable to 80 kHz.
Accuracy: ±4 kHz.

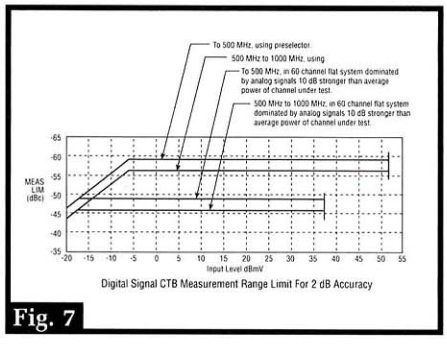
Cross Modulation – Peak of fundamental component of 3rd order distortion at horizontal sync frequency (AM) measured on the unmodulated visual carrier.
Range: 48 dB. For cross modulation levels below –20 dBc, equivalent frequency domain measurement of cross modulation results in a range of 58 dB.
Resolution: 0.1 dB.
Accuracy: ± 2 dB for cross modulation <36 dB; ±3 dB for cross modulation <48 dB.

Listen Mode – Selected channel's aural carrier is FM demodulated and output fed to speaker or headphone jack; instantaneous peak FM deviation is displayed. If positive polarity video is selected, then AM audio will be demodulated.

View Picture Mode – Visual carrier is demodulated and displayed.

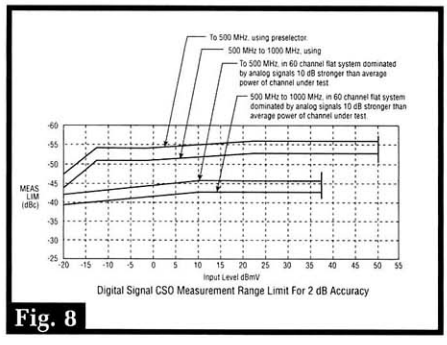
View Modulation (Field) – One video field of the selected channel's video is displayed.

View Modulation (Line) – VITS line displayed; If VITS line isn't specified in channel table, line 17 displayed. Line number user-selectable.
TV Line Selection: Via FREQ/MKRS knob.
Line Format: NTSC or PAL.
Line Range: 1-525 (NTSC); 1-625 (PAL).
Sweep Time: 10 µsec/div.



Digital Signal CTB Measurement Range Limit For 2 dB Accuracy

Fig. 7



Digital Signal CSO Measurement Range Limit For 2 dB Accuracy

Fig. 8

Specifications

FREQUENCY RELATED

Frequency Range – 9 kHz to 1800 MHz.

Center Frequency Accuracy – $5x10^{-7}$ of center frequency ±700 Hz.

Frequency Counter Accuracy – $5x10^{-7}$ of center frequency ±10 Hz ±1 LSD (least significant digit).

Dot Marker Frequency Accuracy – Center frequency accuracy +3% of span, typical.

Frequency Counter Readout Resolution – 1 Hz or 1 kHz, selectable.

Typical Long-Term Drift – ±2 ppm/year.

Short-Term Drift – ≤400 Hz maximum drift between correction cycles (with SPAN/DIV ≤20 kHz).

Residual FM – ≤100 Hz p-p/20 msec at ≤20 kHz span/div; ≤2 kHz p-p/20 msec at >20 kHz span/div.

Resolution Bandwidth (–6 dB) – 5 MHz, 1 MHz, 300 kHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz, and 300 Hz.

RBW Shape Factor (60 dB/6 dB) – ≤7:1 for RBW ≤1 MHz.

Noise Sidebands – ≤–70 dBc at 30 x RBW for RBW ≤100 kHz.

Video Filter –
Auto: ≈1/100 of RBW.
Manual: 3 Hz to 300 kHz in 1-3 sequence, or WIDE.
Off: ≈RBW.

Frequency Span/Div Range – 100 MHz to 1 kHz selected in 1-2-5 sequence or any value from 100 MHz to 1 kHz via the keypad or UTIL menu, plus 180 MHz and 0 Hz.

Span Accuracy – ±3% measured over the center eight divisions.

AMPLITUDE RELATED

Flatness – ±2 dB (relative to reference level at 100 MHz) measured with 10 dB internal RF attenuation (preamp off).

Vertical Display Modes – 10, 5, 1 dB/div, Linear.

Measurement Range – –90 dBmV (preamp on) to +68.8 dBmV (–139 to +20 dBm).

Display Dynamic Range – 80 dB maximum (Log Mode); 8 divisions maximum (Linear mode).

Reference Level Range –
Log Mode: –21.2 dBmV to +68.8 dBmV (–70 to +20 dBm); –41.2 dBmV to +48.8 dBmV with preamp on.
Linear Mode: 10.83 µV/div to 342.33 mV/div (1.08 µV/div to 34.23 mV/div with preamp on).

Reference Level Steps –
Log Mode: 1 dB or 10 dB.
Linear Mode: 10.83 µV/div to 342.33 mV/div in 1-2-5 sequence; ≥0.2 div/increment with FINE REF LVL STEP activated.

Display Amplitude Accuracy –
10 dB/div: ±1.0 dB/10 dB to a maximum cumulative error of ± 2.0 dB over the 70 dB range and a maximum cumulative error of ± 4.0 dB over the 80 dB range; accuracy and range specifications are affected by the SNR of selected RBW and are valid only for the maximum specified in the following table:

RBW dB	Down
5 MHz	40
1 MHz	40
300 kHz	50
100 kHz	50
30 kHz	60
10 kHz	60
3 kHz	80
1 kHz	80
300 Hz	80

5 dB/div: ±1.0 dB/10 dB to a maximum cumulative error of ±2.0 dB over the 40 dB range.

Cable TV Spectrum Analyzer

2715

1 dB/div: ±1 dB maximum error over the 8 dB range.
Linear Mode: ±5% of full scale.

RF Attenuation Range – 0 to 50 dB in 2 dB steps.

Maximum Sensitivity (at 300 Hz RBW) – –78 dBmV (–127 dBm); –90 dBmV (–139 dBm) with preamp on.

SPURIOUS RESPONSE (PREAMP OFF)

Residual Spurious Response – ≤–51 dBmV (≤–100 dBm) with 0 dB RF attenuation, except at 1780 MHz where the spurious response is ≤–41 dBmV (≤–90 dBm).

3rd Order IM Distortion – ≤–70 dBc from any two on-screen signals with any frequency span.

2nd Harmonic Distortion – ≤–66 dBc measured with 1st mixer input level of ≤+9 dBmV.

LO Emission – ≤–21 dBmV (≤–70 dBm) with 0 dB RF attenuation.

0 Hz Spur – ≤+39 dBmV (≤–10 dBm) reference to input with 0 dB RF attenuation.

INPUT RELATED

RF Input – 75 Ω BNC with quick change to 75 Ω type F connector.

VSWR – With RF Attenuation ≥10 dB: 1.5:1 maximum to 1 GHz.
With 0 dB RF Attenuation: 2:1 maximum to 1 GHz.

Maximum Safe Input – +70 dBmV (0.1 W or 2.2 V) continuous peak with 100 VDC blocking capacitor.

1 dB Compression Point – ≥+34 dBmV (–15 dBm) with 0 RF attenuation and 1st mixer at +19 dBmV (–30 dBm).

SWEEP RELATED

Sweep Selections – Normal, single sweep, and manual scan.

Sweep Times – 1 µsec/div to 2 sec/div in a 1-2-5 sequence.

Sweep Accuracy – ±10% over the center 8 divisions.

Trigger – Free run, internal, external, line, TV line, and TV field.

Trigger Amplitude –

Internal: One division or more of signal.
External: 100 mV peak minimum; DC coupled (15 Hz to 1 MHz).

OTHER INPUTS/OUTPUTS

External Trigger – BNC connector, 10 kΩ impedance, DC coupled, 0.1 µsec minimum pulse width; 50 V (DC + pk AC) maximum.

External Video Input – 100 Ω impedance DC coupled; 0-50 kHz BW; 0-1.6 V (200 mV/div typical) signal input for vertical deflection of CRT beam.

Video Output – 0-1.6 V of video signal, inversely proportional to vertical display amplitude; 0 V is top of screen; 1 kΩ impedance.

Sweep Gate Out – TTL level that is HI while CRT beam sweeps.

Sweep Output – +1.3 to –1.3 V, negative-going ramp, proportional to the horizontal sweep; output impedance ≤50 Ω.

Digital Communications – Either RS-232 or GPIB interface provided as a no-cost option.

ENVIRONMENTAL

Temperature –
Operating: 0° to +50° C (MIL T-28800E).
Nonoperating: –55° to +75° C.

Humidity – Nonoperating: Five cycles (120 hrs) in accordance with MIL-Std-28800E, Class 5.

Vibration – Meets MIL T-28800E, Method 514, Procedure X (modified).

Shock – Operating and nonoperating: Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks.

Altitude –
Operating: 15,000 ft.
Nonoperating: 50,000 ft.

Electromagnetic Compatibility –
EC92 EMC Directive 89/336/EEC:
Emissions: EN50081-1. Radiated emissions, 30 MHz to 1 GHz, EN55022 Class B (CISPR 22 B). Conducted emissions, 150 kHz to 30 MHz, EN55022 Class B (CISPR 22 B). Conducted emissions, power line harmonics. 0 to 2 kHz, IEC 555-213.
Immunity: EN50082-1.Electrostatic discharge, 8 kV, IEC 801-2. Radiated immunity, 27 MHz to 500 MHz, IEC 801-3. No response above –90 dBm in a 3 V/meter field.Fast transients, capacitive clamp, 1 kV power leads, 500 V control leads, IEC 801-4.
Power line surge, 1 kV differential mode, 2 kV common mode, IEC 801-5.

GENERAL CHARACTERISTICS

Power Requirements – 105 W maximum (1.4 A) at 115 V, 60 Hz; operates 48 Hz to 440 Hz, 90 to 132 VAC, or
48 Hz to 63 Hz, 90 VAC to 250 VAC; battery power option available.

Dimensions (H,W,D) with Feet, Handle, and Front-Panel Cover

	mm	in.
	137 x 361 x 445	5.4 x 14.2 x 17.5
Weight	**kg**	**lbs.**
	<10.6 kg	23.5 lbs

OTHER CAPABILITIES

Markers – Single marker/delta marker; next right, next left peaks; next lower, next higher peaks; (highest) peak find; marker to center frequency; select start/stop frequencies; transpose Δ markers.

Measurement Modes – Noise, carrier-to-noise, bandwidth (user-definable "dB down" points), 99% occupied bandwidth, signal search, and cable TV measurements (see Cable TV).

Time Delay Setup – Uses built-in time-of-day clock to initiate measurement sequences and sequence repeat interval; START TIME, REPEAT INTERVAL, RUN N TIMES.

PC-Based Software Package – Provides report generation, test data analysis, data history, channel tuning table definition, user-defined program definition, limits checking, alarming and 271X display transfer.

Nonvolatile Memory – Lithium battery backup, 124 K available; used to save cable TV measurement results, setup table parameters, large user-definable key routines, antenna tables, and channel tuning tables.
Saved Displays: 108 maximum.
Saved Front-Panel Setups: 36 maximum.

Digital Storage Display – Selectable acquisition modes of positive peak only, positive/negative peak; SAVE A, B, C, and active D trace; up to four traces on screen; MAX HOLD A, B; MIN HOLD C; B, C minus A; TITLE MODE; digital storage off provides analog display.

Ensemble Averaging – Provides weighted averaging of display, results in reduction of measured noise values and impulse signals.

Direct Entry of Control Parameters – Frequency, span/div, reference level; RBW, video filter, vert. scale, and sweep rate via menu.

Cable TV Spectrum Analyzer
2715

Internal Preamp – Preamp can be switched in/out of circuit (degrades flatness above 600 MHz, provides a maximum of 12 dB sensitivity improvement).

Alternate Reference Level Units – dBm, dBmV, dBV, dBµV, dBµW, dBµV/m (dBmV and dBµV only in CATV measurement mode).

dBµV/m Mode – Automatically compensated field strength measurement with up to five user-selected antennas.

User-Definable Power-On Status – Instrument powers up to user-definable state or supplied default settings.

Constant Rate Tuning – Same on-screen tuning sensitivity regardless of span/div selection.

Center Measure – Signal nearest center frequency is centered with frequency and peak amplitude automatically read out (not a marker mode); the centered signal is counted.

Signal Track – Drifting signal is kept at display center with correct frequency and peak amplitude displayed.

Graticule Illumination – Contrast enhancement for CRT photography.

Direct Plot/Print – Supports Epson FX and LQ Series Printers using RS-232 interface, or HPGL compatible plotters via GPIB interface.

External Tracking Generator Opt. 5 – Provides scalar analysis for checking/aligning filters, amplifiers, cables or most 2-port networks. Includes LO output port.

TV Sideband Analyzer/LO Output Opt. 15 – Provides a 1st LO output for a 1405 TV Sideband Analyzer for frequency-agile modulator sweep.

Rackmount Opt. 30 – Converts unit to a rackmounted installation; 5.25-in. rack height, 19-in. rack width.

Portable-to-Rack Adapter Opt. 34 – Provide rackmounting of instrument in standard enclosure with handle, offering immediate instrument portability when needed; 7-in. rack height, 19-in. rack width.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

2715 CABLE TV SPECTRUM ANALYZER
Includes: Windows-compatible PC Software, Power Cord (U.S. 115 V/60 Hz), User Manual, Programmer Manual, Reference Manual, Front Cover, 75 Ω BNC Connector, 75 Ω F Connector, and Choice of GPIB or RS-232 Interface (Opt. 03 or Opt. 08).

Opt. 03 – Provides an IEEE-488 General Purpose Interface Bus (GPIB) as a no-cost option (not compatible with Option 08).

Opt. 05 – 100 kHz-1.8 GHz External Tracking Generator with mechanical mating kit (includes Opt. 15). Cannot be mounted to 2715 simultaneously with Option 07 Battery Pack.

Opt. 07 – Battery Pack/Inverter.

Opt. 08 – Provides an RS-232 port as a no-cost option (not compatible with Opt. 03).

Opt. 15 – 1st Local Oscillator Output for a 1405 TV Sideband Analyzer or 2707 External Tracking Generator.

Opt. 30 – Rackmount Adapter for 19 x 5.25-in. Rack Dimensions.

Opt. 33 – Travel Line package
Includes: Rain Cover, Accessory Pouch, Gray Filter, and Carrying Strap.

Opt. 34 – Portable-to-rackmount Adapter for 19 x 7-in. Rack Dimensions.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – UK 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

OPTIONAL ACCESSORIES
75 Ω Coaxial Cable, BNC, 24 in. – Order 012-1339-00.
75 Ω Coaxial Cable, BNC, 42 in. – Order 12-0074-00.
F Series Input Adapter/Connector Replacement – Order 103-0301-00.
BNC Input Adapter/Connector Replacement – Order 103-0310-00.
RS-232 Cables –
9-pin to 9-pin Null Modem. Order 012-1379-00.
25-pin to 9-pin Null Modem. Order 012-1380-00.
25-pin to 9-pin RS-232 Cable. Order 012-1214-00.

GPIB Cables –
1 meter. Order 012-0991-01.
2 meter. Order 012-0630-01.
Rain Cover – Order 200-2500-00.
Accessory Pouch – Order 016-0677-02.
Viewing Hoods –
Collapsible. Order 016-0592-00.
Polarized. Order 016-0180-00.
Binocular. Order 016-0566-00.
Carrying Strap – Order 346-0199-00.
CRT Light Filter (Gray) – Order 337-2775-02.
Transit Case – Order 016-0792-02.
Front Panel Cover – 200-2520-00.
Softside Carrying – Case 016-1158-01.
Service Manual – 070-9096-00.
User Manual – 070-9115-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *2712, 2711 Option 03 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

TV Sideband Adapter

1405

Features

1405

- Facilitates In-service or Out-of-Service Testing of Transmitter
- Measure Transmitter Frequency Response to Within ±0.2 dB
- Video Circuits Can Be Swept
- Check Aural FM Deviation with Built-in Bessel Null Technique
- Flexible Marker System Will Accept Standard Crystals
- UL Listed 1244, CSA Bulletin in 556B
- Frequency Range to 1 GHz
- Output Amplitude 0 to 100 IRE
- APL 0 to 100 in 10 IRE Steps
- Compatible with 525/60 or 625/50 Systems

1405

1405 TV Sideband Adapter

The 1405 Sideband Adapter works with 271X Series Spectrum Analyzers to analyze the sideband and in-band response of a television transmitter. It generates a composite video signal, the "picture" portion of which is a constant amplitude sinusoidal signal that sweeps continuously and periodically between 0 and 15 MHz. This signal is applied as modulation to a modulator or transmitter. The output is displayed on the spectrum analyzer and appears as a response curve, typically to within ±0.2 dB, of the transmitter being tested.

The 1405/Spectrum Analyzer combination displays frequency characteristics of RF and IF circuits with frequencies to 1 GHz. Video circuits can also be analyzed.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

1405
TV Sideband Adapter 525/60 Markers.
Includes: Instruction Manual (070-2078-00).

Opt. 01 – TV Sideband Adapter (625/50 Markers).

Opt. 03 – Dial Readout for 271X Series Spectrum Analyzers.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

See Customer Information Section for additional description.

MEASUREMENT SERVICE OPTIONS

Opt. R3 – Repair warranty extended to cover three years

Opt. R5 – Repair warranty extended to cover five years.

Rackmount Conversion Kit – Standard 19 in. Rack. Order 016-0489-00.

Tracking Generators

2707 • 2711/2712 Opt. 04 • 2711/2712/2714 Opt. 05

Features

2707, 2711/2712 OPT. 04 AND 2711/2712/ 2714 OPT. 05

- 2707 External Tracking Generator (271X Opt. 05) for 2711 and 2712 (Must be Used for Tracking Generator Capability with 2712 Opt. 12 or 14) and 2714/2715
- Internal Tracking Generator for 2711 and 2712 (Opt. 04)
- Swept Measurements 100 kHz to 1.8 GHz
- Output from –48 dBm to 0 dBm (–1.2 dBmV to 46.8 dBmV) in 0.1 dB Steps
- Easy to Operate
- Frequency Offset Capability

Applications

- CATV – Check Filters, Amplifiers and Cables
- EMI – Site Attenuation Tests, Filter Design, and Isolation Checks
- Broadcast – Check Traps and Filters
- Communications Radio Maintenance – Tune Duplexers, Check Antennas

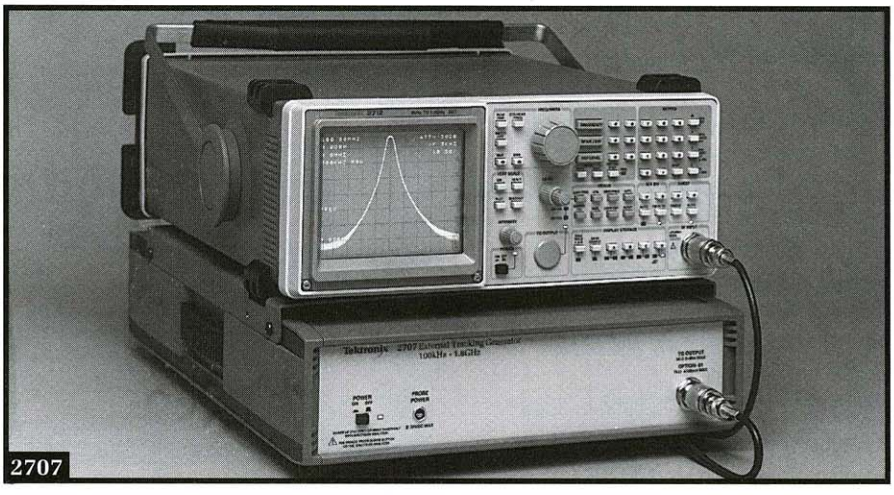
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.



Internal and External Tracking Generators

Characterize filters, check duplexers or cables, make frequency response, SWR measurements (with a return-loss bridge), EMI site attenuation tests – all this and much more. The 2707, 2711/2712 Option 04 (internal) and 2711/2712/2714 Option 5 (external) tracking generator systems provide swept measurements from 100 Hz to 1.8 GHz and at least 100 dB dynamic range to see filter, ultimate rejection, or circuit isolation characteristics.

Characteristics (with 271X Series)

2711/2712 Option 04 Internal Tracking Generator. 2707 External Tracking Generator (271X Option 05*[1]).

Frequency Range – 100 kHz to 1.8 GHz.

Tracking Adjust – Accommodates delay devices (long coaxial cables, etc.).

Output Range – 0 dBm to –48 dBm; Option 01: –1.2 dBmV to 46.8 dBmV.

Output Setting Resolution – 0.1 dB.

Manual Level Adjust – Continuous between attenuator steps.

VSWR – ≤2:1 or better with Output Level ≤–8 dBm.

Tracking Generator Flatness – ±1 dB from 100 kHz to 1.0 GHz and ±1.5 dB to 1.8 GHz.

User Corrected Flatness (B, C minus A) – Typically ±0.2 dB.

Dynamic Range (System) – ≥100 dB typical.

Spurious Responses (harmonically related) – ≤–20 dBc at ≥100 kHz.

Spurious Responses (non-harmonically related) – ≤–30 dBc at ≥100 kHz.

Request External Tracking Generator Data Sheet or Internal Tracking Generator Data Sheet for full characteristics.

**[1] Option 15, 1st LO output, must be installed in 271X Spectrum Analyzers to be used with the 2707. See compatibility kits below.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative,inside the U.S. see the price list in the back of this catalog.

2707
External Tracking Generator.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

2711/2712/2714 OPTION 05
External Tracking Generator.
Includes: Power Cord, 50 Ω SMA Cable, Type N Male-to-BNC Female Adapter, 15-Pin Male-to-15-Pin Male High Density D-sub Cable Assembly. Mounting Bracket with Mounting Hardware, Trim Strips, Instruction Manual.

Opt. 01 – 75 Ω output.

2711/2712 OPTION 04
Internal Tracking Generator.
See page 187 for more information.

2707 COMPATIBILITY KITS
2711, 2712, and 2714 with Opt. 15 (1st LO output) Installed. Order 040-1406-00.
2711, 2712, and 2714 without Opt. 15 Installed. Order 040-1407-00.
2711, 2712 and 2714 1st LO Output. Order 040-1408-00.

Tracking Generators

TR4153B • TR4154

Features

TR4153B/TR4154

- 100 kHz to 2 GHz (3.5 GHz, TR4154)
- 0 dBm to –59 dBm (Switchable in 1 dB Steps)
- Wide Dynamic Range Scalar Analysis Measurement

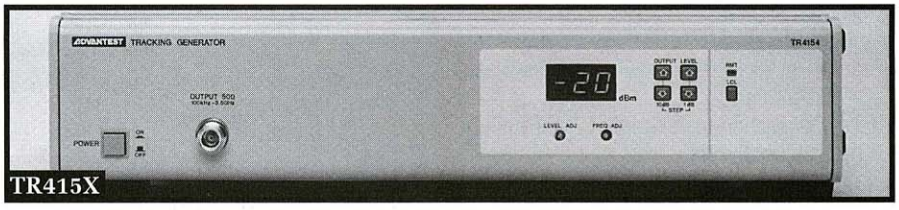
Application

- CATV – Check Filters and Amplifiers
- EMI – Site Attenuation Tests, Filter Design, and Isolation Checks
- Broadcast – Check Traps and Filters
- Communications Radio Maintenance – Tune Duplexers, Check Antennas

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.



TR4153B/TR4154

The TR4153B/TR4154 Tracking Generators provide swept frequency operation for the R4131D Spectrum Analyzer.

TR4153B Characteristics

Frequency Range – 100 kHz to 2 GHz.

Output Impedance – Approximately 50 Ω.

Output VSWR – 100 kHz to 1.5 GHz: 1.5 maximum.
1.5 GHz to 2.0 GHz: 2.0 maximum.

Output Level Flatness – ±0.7 dB maximum (with respect to 200 MHz output, over an output level range of 0 to –10 dBm and frequency range of 100 kHz to 2 GHz).

Output Level Variable Range – 0 to –10 dBm or greater, continuously variable.

Spurious Output Components –
Harmonics: ≤20 dBc.
Non-harmonics: ≤30 dBc (at 0 dBm output).

Tracking Generator Leakage – –110 dBm.

Output Connector – Type N.

Environmental – Operating temperature: 0°C to 40°C.
Humidity: 85% maximum.

Power Requirements –
Line voltage: 90 to 110 V.
Line frequency: 50 to 60 Hz.
Power consumption: 50 VA maximum.

TR4154 Characteristics

Frequency Range – 100 kHz to 3.5 GHz.

Output Impedance – Approximately 50 Ω.

Output VSWR – 100 kHz to 2 GHz: 1.5 maximum.
2 GHz to 3.5 GHz: 2.0 maximum (at output level of –10 dBm or lower).

Output Level Accuracy – ±0.5 dB (at 200 MHz, –10 dB output, +20°C to +30°C).

Output Level Flatness – 100 kHz to 2 GHz, –10 dBm output: 2 dB p-p. 100 kHz to 3.5 GHz, –10 dBm output: 4 dB p-p.

Output Level Switching Accuracy (with respect to –10 dBm output, over an output level range of 0 to –59 dBm) – 100 kHz to 2 GHz, ±2 dB. 100 kHz to 3.5 GHz, ±2.5 dB.

Spurious Output Components (at 0 dBm output) – Harmonics: ≤20 dB. Non-harmonics: ≤30 dB.

Tracking Generator Leakage – –110 dBm or less.

Output Connector – Type N.

Environmental – Operating temperature: 0°C to 40°C.
Humidity: 85% maximum.

Power Requirements –
Line voltage: 90 to 110 V.
Line frequency: 50 to 60 Hz.
Power consumption: 50 VA maximum.

PHYSICAL CHARACTERISTICS

	TR4153B		TR4154	
Dimensions	**mm**	**in.**	**mm**	**in.**
Height	90	3.5	88	3.5
Width	300	11.8	424	16.7
Depth	440	17.3	440	17.3
Weight	**kg**	**lbs.**	**kg**	**lbs.**
Net	10	22	10	22

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TR4153B
Tracking Generator.
Includes: Power Cable, Output Cable, SMA Connecting Cable, BNC Connecting Cable.

TR4154
Tracking Generator.
Includes: Power Cable, Output Cable, SMA Connecting Cable, BNC Connecting Cable.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

ADDITIONAL ACCESSORIES
Also see page 438.

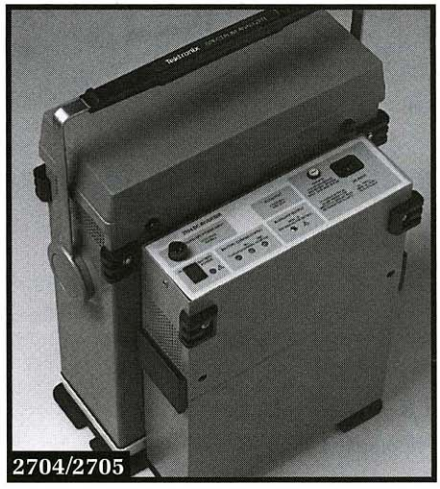
Inverter/Battery Pack

2704 • 2705

Features

2704/2705

- Easy Connection to Tektronix 271X Family Spectrum Analyzers
- 115 W of AC Power
- Continuous Power Using Sequential Battery Packs
- Lightweight Single Package for Easy One-handed Carrying
- Automatic Charging of Two Battery Packs Simultaneously
- Auxiliary 18 V DC LNB Power
- Low Battery Warning



2704 Inverter/ 2705 Battery Pack

The 2704 Inverter and 2705 Battery Pack can provide for operation of 271X spectrum analyzers in locations where AC power is not available. These units mount directly on the spectrum analyzer to form a portable package.

Several 2705s can be used to provide an uninterruptible power source for the spectrum analyzer or other equipment. The 2704 includes a battery charger, and provides an auxiliary 18 volt output. The 2704 also accepts 12 volt input from other sources, such as car batteries. These units are described in more detail in the Inverter/Battery Pack Data Sheet.

Characteristics

2704 INVERTER

DC Input (main and auxiliary) – 11.25 V DC to 15 V DC.

Output Voltage – 115 V AC RMS ±10%.

Output Frequency – 60 Hz ±5%.

Output Waveform – Quasi-sinusoid.

Output Power – 115 W maximum continuous.

Battery Charger – AC input voltage (90 V AC to 250 V AC, 50/60 Hz). AC power consumption 70 W typical.

Auxiliary Output for LNB Voltage – 18 V DC ±10%. Ripple, 200 mV typical. Maximum output current 1 A (current limited).

2705 BATTERY PACK

Type – Sealed lead-acid.

Minimum Operating Time – 50 min at 10°C to 40°C, 45 minutes at 0°C to 10°C.

Charging Time (using 2704) – Eight hours typical for one battery pack, 12 hours for two battery packs, fully discharged state, 0°C to 40°C.

Cycle Life – ≥125 charge/discharge cycles to 100%.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

2704
Inverter.
Includes: Power Cord (U.S. 115 V, 60 Hz), Operator's Manual, Analyzer Mounting Plate.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

2705
Battery Pack.
1.5 Meter DC Power Cord –
2704 Inverter-to-Automotive Cigarette Lighter Plug. Order 118-8549-00.
1.5 Meter DC Power Cord –
2704 Inverter-to-Alligator Clips. Order 118-8550-00.

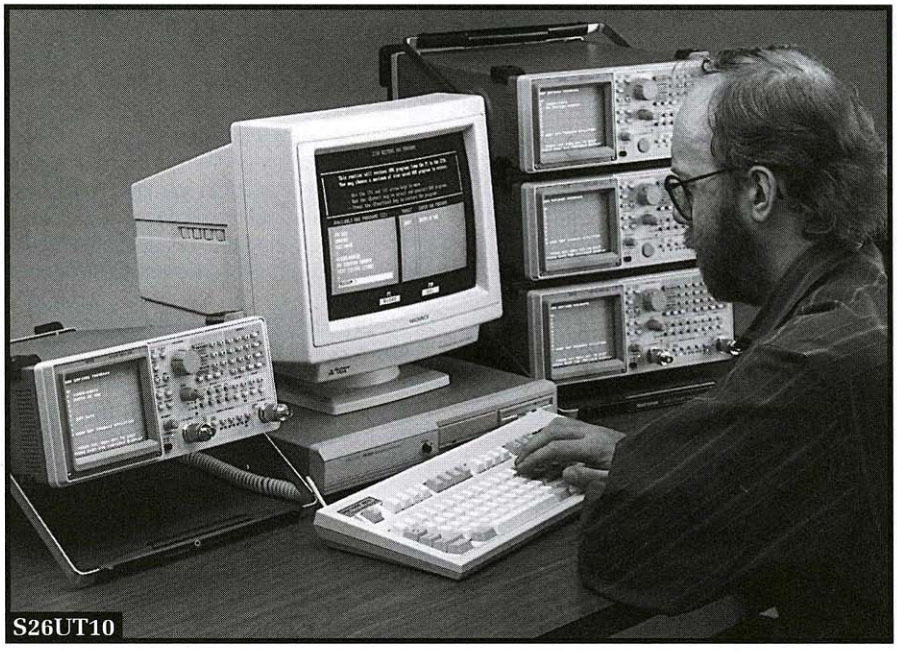
INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.
See Customer Information Section for additional description.

Spectrum Analyzer Software
S26UT10

Features

S26UT10

- Performs Automated Spectrum Analysis on PC-compatible Controllers
- Measurement Data May Be Stored to Disk, or Included As Part of a Report or Document


S26UT10

S26UT10 271X/PC Utility Software

Tektronix' 271X/PC Utility Software is designed to extend the storage capabilities as well as automate some of the more common functions of the 271X Spectrum Analyzers. These include waveform acquisition, graphing, documentation, storing to disk, comparing, subtracting, recalling from disk, and sending to the analyzer. Both single traces and groups of related traces can be manipulated.

The software provides utility routines for operations such as TALK/LISTEN (sending commands and receiving responses), selecting the color of waveform graphs and annotation, and specifying the drive or path under which waveforms and other files will be stored.

The software includes an application category which can be supplemented with user-specific applications. This category contains a waterfall application, an occupied bandwidth measurement application, and an application to save, recall, and transfer User-defined Programs to other 271X analyzers equipped with a communications port.

The measurement category contains a program to measure harmonic distortion and a program to check swept frequency response. The latter uses the optional, fully programmable 271X tracking generator to measure peak-to-valley response within a specified frequency range.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

S26UT10
2710 Series PC Utility Software.
Includes: Software on 5.25 in. and 3.5 in. Diskettes.

Opt. 09 – Source Code.

Network Analyzers

CONTENTS

R3765AH.....200
R3765BH.....200
R3765CH.....200
R3767AH.....200
R3767BH.....200
R3767CH.....200

For Production Test

Network analyzers can be used to characterize a variety of devices, from components and materials to circuits, equipment, and systems. They can be used effectively even when individual components or test points cannot be accessed. Network analyzers measure the transmission and reflection characteristics of linear circuit networks by applying a sine wave to the input of the device-under-test (DUT) and measuring the resultant signals at the output. The most accurate way to analyze linear circuit networks is to measure the amplitude and phase versus frequency of circuit network transmission and reflection characteristics at various frequencies. Knowing these relationships provides the information required to characterize the behavior of linear networks quickly, accurately, and completely over a broad frequency range.

NETWORK ANALYZER MEASUREMENTS

Figure 1 shows the effect of an incident wave (input signal) applied to a device-under-test. The incident wave can be divided into two parts: Reflection waves that return to the source without passing through the DUT and transmission waves that pass through the DUT.

The reflection characteristic can be obtained by dividing the reflection wave by the incident wave:

$$\text{Reflection Characteristic} = \frac{\text{Reflection Wave}}{\text{Incident Wave}}$$

The following items can be measured from this calculation:

- Return loss
- SWR
- Impedance (R + φX, G + φB)*1
- S parameter (S11, S22)*1

The transmission characteristic can be obtained by dividing the transmission wave by the incident wave:

$$\text{Transmission Characteristic} = \frac{\text{Transmission Wave}}{\text{Incident Wave}}$$

The following items can be measured from this calculation:

- Amplitude
- Phase *1
- Group delay time*1
- S parameter (S11, S22)*1

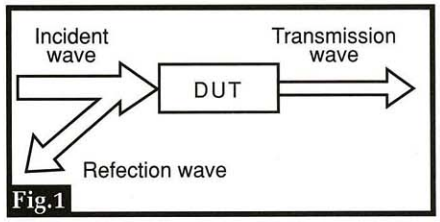


Fig.1

TWO TYPES OF NETWORK ANALYZERS

There are two general types of network analyzers: Scalar network analyzers and vector network analyzers. A scalar network analyzer is a low-priced network analyzer, but it only provides partial network characterization. Basically, a scalar network analyzer only measures the amplitude components of transmission and reflection.

A vector network analyzer measures the phase and group delay times in addition to the amplitude components of transmission and reflection. This provides complete, accurate characterization of linear circuit networks.

To provide accurate network analysis, the following performance is required:

- High accuracy, high resolution
- High throughput
- Flexible application to various systems
- Abundant functions
- Easy operation

*1 *Cannot be measured by a scalar network analyzer.*

Network Analyzers

R3765H • R3767H

Features

R3765H, R3767H

- 40 MHz to 3.8 GHz Measurement Frequency Range (R3765)
- 40 MHz to 8.0 GHz Measurement Frequency Range (R3767)
- Three Models Available:
  - Type A Basic Model
  - Type B with Built-in SWR Bridge
  - Type C with Built-in S-Parameter Test Set
- High Sweep Speed
  - 0.10 ms/point with normalized calibration
  - 0.20 ms/point with two-port full calibration

Applications

- High-speed Automated Test
- RF and Wireless Communications
- Satellite Broadcasting Equipment
- Component Test
- Manufacturing Test
- Test Program Development

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

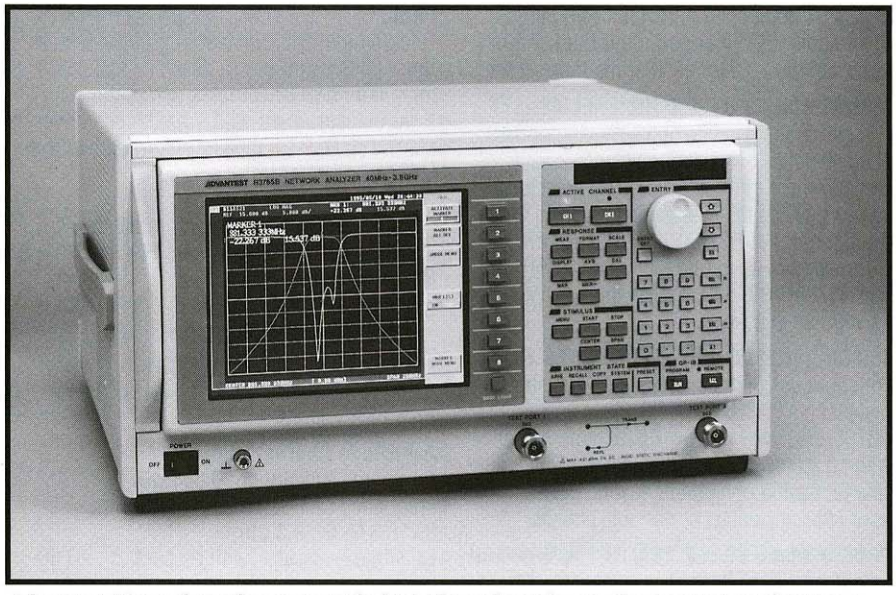
GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.



Advantest Network analyzers provide high throughput for production test applications.

R3765H/R3767H Network Analyzers

The R3765H/R3767H Network Analyzers feature unprecedented measurement speed and productivity enhancements. The R3765 analyzer covers the frequency range from 40 MHz to 3.8 GHz; the R3767 extends the upper frequency limit to 8 GHz. These analyzers are designed specifically for testing components in the rapidly expanding field of RF and wireless communications (cellular phones, pagers, cordless phones, etc.).

HIGH THROUGHPUT WITH RELIABLE MEASUREMENT

The R3765H/R3767H provide high throughput and highly reliable measurement. They achieve high-speed measurement (0.1 ms/point at 10 kHz RBW), wide dynamic range measurement (100 dB), two device simultaneous measurement with 4-channel 8-trace function, and other useful functions. Besides a conventional frequency sweep function, several new concepts have been added. First, a program sweep function allows the user to freely change resolution bandwidth or output level at any point during the sweep. Second, a high-speed level sweep uses a new semiconductor switch at the output section and is ideal for drive level performance testing of quartz oscillators.

STANDALONE MEASUREMENT FEATURES

The R3765H/R3767H are designed for standalone benchtop use and high-speed ATE system applications. They feature a TFT (thin film transistor) color liquid crystal display for measurement results. This flat-panel display enhances visibility and operability which are important for interpreting and analyzing the results of measurements (such as data comparison and pattern recognition).

On-screen menus and soft keys provide access to a wide variety of routines for both transmission and reflection measurements. These include displays of magnitude, phase, group delay, SWR, Smith Charts, or combinations of these.

BUILT-IN CONTROLLER FUNCTION

The R3765H/R3767H have a built-in BASIC controller function for configuration of a high-speed ATE system without using an external controller. A 3.5 in. MS-DOS compatible 1.44 MB floppy disk drive is also standard. This allows programs to be written on a PC-compatible controller and easily ported to the network analyzer.

POWERFUL 4-CHANNEL/8-TRACE FUNCTION WITH SIMULTANEOUS DISPLAY

The R3765H/R3767H provide 4-channel/8-trace function with simultaneous display capability. For example, when a 3-port test adapter is connected to the R3765H/R3767H, simultaneous and real-time measurement of Tx/Rx characteristics of the duplexer is possible. Channels 1 and 3 measure four S-parameters of Tx and channels 2 and 4 measure those of Rx at the same time with a throughput of approximately 250 ms

Network Analyzers
R3765H • R3767H

(with 201 points and 2-port full calibration). In addition, limit lines and multi-marker functions can be used for each of the four screens.

HIGH THROUGHPUT AND HIGH RELIABILITY
Total throughput is one of the most important characteristics of an electronic component measurement system. Among many factors, sweep rate has the greatest influence on total throughput. The R3765H/R3767H achieve a 0.1 ms/point sweep rate (at 10 kHz RBW). The R3765H/R3767H realizes the highest throughput in its class.

100 DB DYNAMIC RANGE FOR FILTER TEST
For spurious checks in stop band, measurement with a wide dynamic range is crucial. The R3765H/R3767H realize 100 dB dynamic range with 10 Hz resolution bandwidth, making it suitable for testing of high-attenuation devices used in base stations or portable phones.

PROGRAMMED SWEEP REALIZES HIGH-SPEED AND HIGH-RESOLUTION MEASUREMENTS
The R3765H/R3767H have a programmed sweep function which makes it possible to vary output power and resolution bandwidth (RBW) during a sweep. In evaluation of filter characteristics, for example, measurement with high speed, high accuracy, and high reproducibility can be realized by varying resolution bandwidth and output power within the pass band or stop band.

LIMIT LINE FUNCTION FOR ADJUSTMENT AND TEST
The limit line function performs PASS/FAIL tests based on the judgement value set by the limit line editor. It then displays the test result. In addition, the color of the limit lines and waveform data can be specified for each judgement area, allowing the user to make PASS/FAIL decisions at a glance. In POLAR and Smith chart measurement, the ability to make limits judgements both for amplitude and phase allows amplitude/phase adjustment for specified frequency ranges with automatic test result

Characteristics

MEASUREMENT FUNCTIONS
Sweep Channel – 2 channels (CH 1 and CH 2).

Display Channel – 4 channels (CH 1, CH 2, CH 3, CH 4).

Display Parameters –
Type A: A/R, B/R.
Type B: Transmission, Reflection, Transmission and Reflection.
Type C: S11, S21, S22, S12, S21 and S11, S12 and S22.

Format –
Rectangular Coordinates: Log/linear amplitude, phase, and group delay, or real part + imaginary part of complex parameter |Z|, R, X (at measurement with impedance conversion), |Y|, G, B (at measurement with admittance conversion).
Smith Chart:
Marker reading: Log/linear amplitude, phase, real + imaginary part, R + φX, G + φB.
Polar Coordinates:
Marker reading: Log/linear amplitude, phase, real + imaginary part.

RECEIVER CHARACTERISTICS
Resolution Bandwidth – 10 kHz to 10 Hz (in 1 or 3 steps).

Amplitude Characteristics –
Amplitude Resolution: 0.001 dB.
Frequency Characteristics (–10 dBm, 25° C ±5° C): 1.0 dBm.
Dynamic Accuracy (with respect to –20 dB below maximum input level of test port):
0 to –10 dB:
40 MHz ≤f ≤ 3.8 GHz: ±0.3 dB.
3.8 GHz ≤ f ≤ 8.0 GHz: ±0.8 dB.
–10 to –20 dB:
40 MHz ≤f ≤ 3.8 GHz: ±0.05 dB.
3.8 GHz ≤ f ≤ 8.0 GHz: ±0.2 dB.
–20 to –50 dB: ±0.05 dB.
–50 to –60 dB: ±0.15 dB.
–60 to –70 dB: ±0.15 dB.
–70 to –80 dB: ±0.40 dB.
–80 to –90 dB: ±1.00 dB.

Phase Characteristics –
Measurement Range: ±180° (display of ±180° or more is possible with display extension function).
Phase Resolution: 0.01°.
Frequency Characteristics (–10 dBm, 25° C ±5° C): ±5°.
Dynamic Accuracy (with respect to –20 dB below maximum input level of test port):
0 to –10 dB: ±5.0°.
–10 to –20 dB:
40 MHz ≤f ≤ 3.8 GHz: ±0.3°.
3.8 GHz ≤ f ≤ 8.0 GHz: ±0.8°.
–20 to –50 dB: ±0.3°.
–50 to –60 dB:
40 MHz ≤f ≤ 3.8 GHz: ±0.4°.
3.8 GHz ≤ f ≤ 8.0 GHz: ±0.8°.
–60 to –70 dB: ±1.5°.
–70 to –80 dB: ±4.0.
–80 to –90 dB: ±8.0°.

Group Delay Time Characteristics –
Range: Calculated by the following expression:

$$r = \frac{\text{phase}}{360 \times \text{aperture frequency (Hz)}}$$

Measurement Range: 1 ps to 250 s.
Group Delay Time Resolution: 1 ps.
Aperture Frequency: Can be set to A x 2% to A x 100% for frequency span, with resolution of A x 2%:

$$A = \frac{100}{\text{measurement points} - 1}$$

Accuracy:

$$= \frac{\text{phase accuracy}}{360 \times \text{aperture frequency (Hz)}}$$

SIGNAL SOURCE CHARACTERISTICS
Measurement Frequency –
Range:
R3765: 40 MHz to 3.8 GHz.
R3767: 40 MHz to 8.0 GHz.
Set Resolution: 1 Hz.
Measurement Resolution: ±0.005 ppm.
Accuracy: ±20 ppm (25° C ±5° C).

Output Level –
40 MHz to 3.8 GHz:
Range:
Type A: +17 dBM to –8 dBm.
Type B: +7 dBm to –18 dBm.
Type C: +10 dBm to –15 dBm.
Resolution: 0.01 dB.
Linearity (25° C ±5°C):
Type A (with respect to +7 dBm):
+12 dBM to –3 dBm: ±0.4 dB.
+17 dBM to –8 dBm: ±0.7 dB.
Type B (with respect to –3 dBm):
+2 dBM to –13 dBm: ±0.4 dB.
+7 dBM to –18 dBm: ±0.7 dB.
Type C (with respect to 0 dBm):
+5 dBM to –10 dBm: ±0.4 dB.
+10 dBM to –15 dBm: ±0.7 dB.
Flatness (Type C at test port, 25° C ±5° C):
20 $dB_{p\text{-}p}$.
3.8 GHz to 8 GHz (R3767):
Type A: –3 dBm or more.
Type B: –16 dBm or more.
Type C: –13 dBm or more.

Output Impedance – 50 Ω.

Network Analyzers
R3765H • R3767H

Signal Purity (at maximum output) –
Harmonic distortion (40 MHz to 3.8 GHz): ≤20 dBc.
Non-harmonic spurious (40 MHz to 3.8 GHz): ≤25 dBc.
Phase noise (10 kHz offset, 1 Hz BW): ≤–85 dBc to 20 log (F/40 MHz).

SWEEP FUNCTION
Sweep Parameter – Frequency, signal level.

Maximum Sweep Range –
Frequency:
R3765: 40 MHz to 3.8 GHz.
R3767: 40 MHz to 8.0 GHz.
Signal Level:
Type A: +17 dBm to 8 dBm.
Type B: +7 dBm to –18 dBm.
Type C: +10 dBm to –15 dBm.

Sweep Type (minimum sweep time differs according to measurement format, type of error correction, sweep width per point, number of measurement points, and IF bandwidth) –
Normalized Calibration: 0.15 ms/point.
2-port Full Calibration: 0.25 ms/point.

Measurement Point – 3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 801, 1201 points.

Sweep Trigger – Continuous, hold, single, external.

Sweep Mode –
Dual Sweep: Sweeps two channel (CH 1 and CH 2) with the same frequency range.
Alternate Sweeps two channels (CH 1 and CH 2) with different sweep types and frequency ranges.

TEST PORT CHARACTERISTICS
Test Port Load Matching (25° C ±5° C) –
0 MHz to 2.6 GHz: 18 dB.
2.6 GHz to 3.8 GHz: 16 dB.
3.8 GHz to 8.0 GHz (R3767): 14 dB.

Directivity (25° C ±5° C) –
40 MHz to 2.6 GHz: 40 dB.
2.6 GHz to 3.8 GHz: 26 dB.
3.8 GHz to 8.0 GHz (R3767): 22 dB.

Crosstalk (25° C ±5° C) –
R3765:
Types A and B: 90 dB.
Type C:
40 MHz to 2.6 GHz: 90 dB.
2.6 GHz to 3.8 GHz: 85 dB.
R3767:
Types A and B:
40 MHz to 3.8 GHz: 90 dB.
3.8 GHz to 5.0 GHz: 80 dB.
5.0 GHz to 8.0 GHz: 70 dB.
Type C:
40 MHz to 2.6 GHz: 90 dB.
2.6 GHz to 3.8 GHz: 85 dB.
3.8 GHz to 5.0 GHz: 70 dB.
5.0 GHz to 8.0 GHz: 60 dB.

Connector – Type N female, 50 Ω.

Noise Level (with respect to –20dB below maximum input level of test board) –
3 kHz bandwidth: –90 dB.
10 kHz bandwidth: –100 dB.

Maximum Input Level –
Types A and B: 0 dBm.
Type C:
40 MHz to 3.8 GHz: +15 dBm.
3.8 GHz to 8 GHz: +12 dBm.

Input Damage Level – +21 dBm ±30 V DC.

Maximum Port Bias – ±30 V DC, ±0.5 V (Type C only).

ERROR CORRECT FUNCTION
Normalized – Corrects for frequency response errors (amplitude, phase) during transmission and reflection measurement.

1-Port Compensation – Corrects for errors due to directivity, frequency response, and source matching during reflection measurements. (Short/open/load calibration tools required.)

Data Averaging – Average data (vector value) for each sweep. Averaging factor can be set from 2 to 999.

Data Smoothing – Obtains moving average between adjacent measurement points.

Electrical Length Correction – Adds measured phase and group delay time and equivalent electrical length or delay time.

Phase Offset Correction – Adds measured phase and a constant phase offset.

Correction by Frequency Interpolation – Calculates error coefficient in frequency interpolation mode calibration even when frequency and number of horizontal axis points are changed. Changes in frequency range (start/stop) are applied for the frequency range at initial calibration.

DISPLAY
Display Type – 7.8-inch TFT color LCD.

Resolution – 640 x 480 dots.

Display Mode – Log/linear Cartesian coordinate, polar coordinate, Smith chart (impedance/admittance display).

Display Format: –
Single-channel.
2 channels (overlapped display, separated display).
4 channels (separated display).

Measurement Condition Display – Start/stop, center/span, scale/DIV, reference level, marker value, soft key functions, warning messages.

Reference Line Position – Top (100%) to bottom (0%) of vertical axis memory.

Auto Scale – Sets reference value and scale so measured trace can be displayed in optimum form.
Brightness; Back-light can be turned ON or OFF.

MARKER FUNCTION
Marker Display – Marker reading can be converted into a display value in corresponding to each measurement format.

Multi Marker – 10 markers can be set independently for each channel.

Delta Marker – Each of 10 delta markers can be specified as the reference marker and the delta value between markers can be measured.

Marker Couple – Markers of each channel can be set in coupled or independent manner.

Analysis of Specified Region – Marker search for section specified with Δ marker can be performed.

MRK Search – MAX search, MIN search, and NEXT search.

Marker Tracking – Search operation for each sweep.

Target Search – Calculates bandwidth, center frequency, and Q for –X dB point. Frequency for phase 0° and frequency width of ±X° can be searched for.

MRK→ – MRK→ reference value, MRK→ START, MRK→ STOP, MRK→ CENTER.

INPUT/OUTPUT
External Display – 15-Pin D-SUB connector (VGA).

GPIB – Conforms to IEEE 488 standard.

Parallel I/O – TTL level, 8-Bit output (2 ports), 4-Bit input and output (2 ports).

Serial I/O – Conforms to RS-232 standard.

Keyboard Jack – Compatible with IBM PC-AT.

External Reference Frequency Input –
Input Frequency Range: 1, 2, 5, and 10 MHz ±10 ppm.
Level: >0 dBm.
Impedance: 50 Ω.

PROGRAMMING FUNCTIONS
BASIC Controller Function – Built-in controller function can control internal measurement functions as well as other instruments equipped with a GPIB interface.

Network Analyzers

R3765H • R3767H

Built-in Functions – High-speed analysis of measurement data using built-in functions.

Floppy Disk Drive (FDD) – MS-DOS compatible, 3.5-in., 720 K (DD), 1.2 MB (HD), or 1.44 MB (HD).

ENVIRONMENTAL

Temperature –
Operating:
FDD in use: +5° C to +40° C.
FDD not in use: 0° C to +50° C.
Storage: –20° C to +60° C.

Relative Humidity (without condensation) –
FDD in use: 85% or less.
FDD not in use: 80% or less.

POWER

Line Voltage – 100 to 120 V AC, 220 to 240 V AC. Automatic switching between ranges.

Line Frequency – 48 to 66 Hz.

Power Consumption – 300 VA or less.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	220	8.7
Width	424	16.7
Depth	400	15.7
Weight	**kg**	**lbs.**
Net	16	35.3

R3962A/B S-Parameter Test Set

R3963A/B, R3964A/B DUPLEXER TEST SET/ADAPTER

The R3962A/B S-Parameter Test Set and R3963A/B Duplexer Test Set/Adapter connect to the R3765H/R3767H Network Analyzers to measure transmission/reflection characteristics. The R396X Series test sets, when used in conjunction with the R3765H/R3767H Network Analyzers, makes it possible to switch measurement terminals on the network analyzer automatically without reconnecting the ports.

The R396X Series test sets come with two different models to accommodate diverse measurement device configurations (such as test configuration specialized for duplexers and for 3-port devices). Each model comes with types A and B allowing a total of 4 types of units to be arranged.

Type A is a desktop type incorporating a network analyzer suitable for standalone use (such as the R3765H/R3767H). Type B is a compact, lightweight model which can be separated from the network analyzer and used near the device-under-test.

R396X TEST SET CHARACTERISTICS

Frequency Range – 40 MHz to 8 GHz.

Directivity (25° C ±5° C) –
R3962A/B:
40 MHz to 2.6 GHz: 30 dB.
2.6 GHz to 3.8 GHz: 26 dB.
3.8 GHz to 8 GHz: 22 dB.
R3963A/B:
ANT PORT:
40 MHz to 2.6 GHz: 30 dB typical.
2.6 GHz to 3.8 GHz: 29 dB typical.
3.8 GHz to 8 GHz: 25 dB typical.
TEST PORT1, 2:
40 MHz to 2.6 GHz: 15 dB typical.
2.6 GHz to 3.8 GHz: 20 dB typical.
3.8 GHz to 8 GHz: 8 dB typical.

Test Port Load Match (25° C ±5° C) –
R3962A/B:
40 MHz to 2.6 GHz: 30 dB.
2.6 GHz to 3.8 GHz: 26 dB.
3.8 GHz to 8 GHz: 22 dB.
R3963A/B:
ANT PORT:
40 MHz to 2.6 GHz: 25 dB typical.
2.6 GHz to 3.8 GHz: 20 dB typical.
3.8 GHz to 8 GHz: 14 dB typical.
TEST PORT1, 2:
40 MHz to 2.6 GHz: 18 dB typical.
2.6 GHz to 3.8 GHz: 20 dB typical.
3.8 GHz to 8 GHz: 14 dB typical.

Dimensions –
Type A: 80 mm high, 250 mm wide, 400 mm deep.
Type B: 80 mm high, 250 mm wide, 165 mm deep.

Weight – 5 kg or less.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

R3765AH
40 MHz to 3.8 GHz Network Analyzer.

R3765BH
40 MHz to 3.8 GHz Network Analyzer with Internal VSWR Bridge.

R3765CH
40 MHz to 3.8 GHz Network Analyzer with 2-Port S-Parameter Test Set.

R3767AH
40 MHz to 8 GHz Network Analyzer.

R3767BH
40 MHz to 8 GHz Network Analyzer with Internal VSWR Bridge.

R3767CH
40 MHz to 8 GHz Network Analyzer with 2-Port S-Parameter Test Set.

RECOMMENDED ACCESSORIES

50 Ω Termination – Order 26N50.

75 Ω Termination, Type N – Order 26N75.

50 Ω Calibration Open/Short Connector – Order 22N.

75 Ω Calibration Open/Short Connector, Type N – Order 22N75.

50 Ω DC to 18 GHz Calibration Kit (Type N) – Order 9617A3.

50 Ω DC to 18 GHz Calibration Kit (3.5 mm) – Order 9617F3.

Rackmount w/Handles – Order A02712(EIA).

Rackmount w/o Handles – Order A02722(EIA).

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Power Meters

Electronic Voltmeters

RF MILLIVOLTMETERS

A diode rectifier in the probe changes the unknown RF signal into a DC voltage. This DC voltage is processed in the basic unit and indicated on the display. The non-linear rectifier characteristic is linearized by a control loop or by a calculated correction value.

Using the square weighting of a diode rectifier, RF millivoltmeters measure the RMS value of small voltages up to about 30 mV (or higher with a divider) and the peak or the peak-to-peak value (if a full-wave rectifier is used) of voltages above 1 V. Due to linearization, the meter reads the RMS value of a sine wave in the entire measurement range.

A probe incorporating a capacitively coupled diode is used for measurements on non-coaxial circuits. It features high input impedance and very low input capacitance.

Measurements in coaxial circuits are carried out with the aid of coaxial RF insertion units. They incorporate a diode inserted into the inner conductor or connected via a piston attenuator and permit broadband voltage measurements to be made up to 2 GHz with low SWR. Power sensors can be connected to RF millivoltmeters, so that they can also be used as RF power meters.

RF POWER MEASUREMENT

There are two general types of RF power meters:

- Terminating power meters absorb the test signal and indicate the resistant power
- Directional power meters separately measure the forward and reflected power in an RF line with practically no loss

Terminating power meters are often referred to simply as power meters. They typically have a resistive input impedance of 50 or 75 Ω. Depending upon the principle of operation, either the heat produced is measured, or the RF power at the termination is measured with the aid of a diode rectifier. Conventional power meters with diode probes have a limited dynamic range, since departures from linearity of the diode at as low as 10 µW cause considerable measurement errors. This range can be extended by microprocessor-controlled correction of the rectifier characteristics.

Directional power meters are inserted into an RF line and measure the forward and reflected power separately based upon a directional coupler. Directional power meters can thus be used for simultaneously checking the transmitter output power and the antenna or load matching. Minimum insertion loss is required for the measurement of higher power levels. The measuring instrument can thus remain connected to the transmitter output line for continuous monitoring. Special power sensors with peak weighting are available for measuring pulsed signals (e.g., in GSM/TDMA mobile radio).

MEASUREMENT ACCURACY

The most important characteristics of a voltmeter or power meter are high measurement accuracy and short measurement times. This requires the use of microprocessors and computed correction of factors such as frequency response, temperature effect, and linearity. This relieves the user of error-prone and time-consuming tasks such as recalibration of sensors before measurement, or reading, entering, and calculating correction factors.

STORED CALIBRATION DATA FOR EASE OF USE

The sensors offered for use with the URV and NRV meters are individually calibrated and their calibration data stored in memory. All relevant data required to produce accurate results are stored in calibration-data memory and are available to the meter when plugged in. Even sensor-specific data such as serial number, sensor type, and calibration date are known to the meter, in addition to the permissible measurement and frequency ranges. Only the frequency of the measurement is required; the meter automatically scans the data memory for the relevant calibration factors and interpolates if necessary.

CONTENTS

URV 5 206
URV 35 206
NAS 208
NAP 210
NRVD 212
NRVS 214
Power Sensors, Probes, and RF Insertion Units 216

Power Meters

URV 5 • URV 35

Features

URV 5

- DC, 9 kHz to 2 GHz Frequency Range (26.5 GHz with NRV-Z Sensors)
- 200 µV to 1000 V Measurement Range
- Two Test Inputs
- Microprocessor Error Correction for Unexcelled Accuracy
- Wide Dynamic Range
- Readout in Standard Units with Selectable Reference Impedance
- Relative Measurements
- Individual, Frequency-dependent Calibration Factors Taken into Account
- Optional DC Output

URV 35

- DC to 26.5 GHz Frequency Range
- Compact, Handy, and Mobile
- Voltmeter and Power Meter in One Unit
- Combined Analog and Digital Display
- Menu-guided Operation
- DC Frequency Input for Tracking Frequency-response Correction
- Analog Output of YT Recorder
- Remote Control Interface
- Battery or AC Supply Operation
- Wide Choice of Probes and Sensors
- Rugged Design

Applications

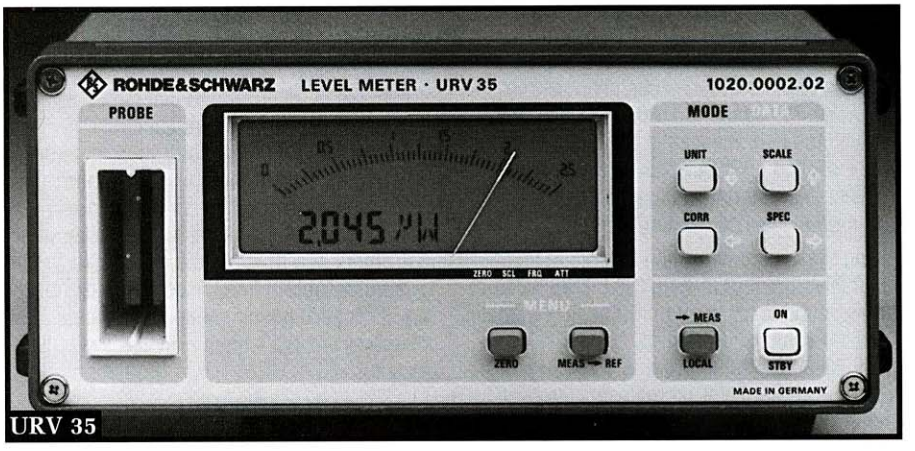
- Service
- Production
- Precision Measurements in RF and Microwave Labs

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *URV5 complies with IEEE Standard 488.1-1987.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



URV 35

URV 5 RF Millivoltmeter

The URV 5 RF Millivoltmeter is a broadband voltage, level, and power meter with high accuracy and sensitivity. It is suitable for both manual operation and use in systems. A great variety of probes, sensors, and accessories allows the URV 5 to be used for all kinds of measurements.

The values measured in the two channels can be displayed separately, set off against one another, or referred to any reference. For relative measurements, the difference, difference in percent, logarithmic difference, or ratio is indicated (ΔV, ΔW, Δ%, ΔdB, X/REF).

The URV 5 has a fast trend indication which follows the variations of the measured value.

URV 35 Level Meter

The URV 35 Level Meter is a precise voltage and power meter for a large variety of applications. It can be used in service and production, as well as for precision measurement in the RF and microwave lab.

The large variety of probes and sensors available opens up a wide level and frequency range. Excellent RF shielding provides precise measurements, even in the near field of antennas.

An intelligent operating concept in conjunction with an auto-range facility reduces the user's work to read the results in standard units, either as absolute or relative values. The appropriate scale is shown on the LCD display for convenient reading of the results.

Filtering, which is dependent upon the level and resolution, as well as the choice between 4 1/2- and 3 1/2-digit readout, optimizes the display of results. Each probe and sensor is calibrated individually. All relevant data of the probes are automatically evaluated in the URV 35.

Characteristics (URV 5)

Probes and Sensors – Compatible with all URV 5 probes and NRV sensors except NRV-Z51, NRV-Z52, NRV-Z53, NRV-Z54 and NRV-Z31.

Test Channels – 2 (A and B).
Dynamic range: >94 dB.
Absolute measurement: A, B.
Relative measurement: A/REF_A, B/REF_B, A/B, B/A.
Absolute readout: V, W, dBm, dBV.
Relative readout: ΔV, ΔW, Δ%, ΔdB, X/REF.
Resolution: 0.01% or dB.
Error limits (18 to 28°C): ±0.15% of reading per channel.
Filter: Reduces display noise in six steps (F0 to F5).
Zero adjustment: Via keyboard or remote control.
Measurement rate (manual): Approximately 1 measurement/second with filter F0, up to 30 measurements/second with filter F5.
Measurement time (IEC/IEEE bus): Approximately 0.05 second with filter F5, up to 20 seconds with filter F0.

PEP Measurement –
Pulse width: Approximately 200 µs to CW.
Minimum pulse repetition frequency:

Filter	F0	F1	F2	F3	F4	F5
f_{min}/Hz	0.05	0.25	1	5	25	100

Power Meters
URV 5 • URV 35

Optional DC Output (URV 5 with Option 01) –
Output voltage range (EMF): –1.999 to +1.999 V into Z_{out} = 1 kΩ.
Resolution: 1 mV (10 digits).
Error: ±2 mV.

Remote Control –
Interface: IEC625-1 (IEEE 488) for control of all device functions.
Interface functions: SH1, AH1, T5, L4, SR1, RL1, DC1, DT1, PP1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	110	4.3
Width	241	9.5
Depth	340	13.4
Weight	**kg**	**lbs.**
Net	4.4	9.7

Characteristics (URV 35)

Probes and Sensors – Compatible with all URV 5-Z probes and NRV-Z sensors.

Frequency Range – DC to 26.5 GHz.

Display – Backlit LCD for display of measured value, units, and meter scale; additional moving-coil meter with short response time.

Absolute readout: dBm, dBµV, V, or W.

Relative readout: dB referred to stored reference value.

Resolution of digital display –
4 1/2 digits: 19,999 steps, 0.001 dB.
3 1/2 digits: 1,999 steps, 0.01 dB.

Analog display: Steps of 1/2.5/5 with readout in V, W, or dB; steps of 5 dB with readout in dBm and windows of 10 dB, manually or automatically selected; free scaling by entry of left-hand and right-hand scale limits.

Display filtering: Level-dependent digital averaging filter.
4 1/2-digit resolution: Averaging over 16 to 256 readings.
3 1/2-digit resolution: Averaging over 1 to 32 readings.

Error Limits (18 to 28°C) –
Digital display: ±0.02 dB ±1 digit.
Moving-coil meter: 1.5% of full scale.

Zero Adjustment – Via interface or manually, approximately 4 s.

HOLD Function – Displayed measurement result retained upon keystroke.

Measurement Rate – Five readouts per second in manual mode.

Frequency-response Correction – Specific calibration data of probe taken into account; frequency entry via keypad, interface, or equivalent DC voltage at rear-panel input.

Attenuation Correction – Attenuation or gain connected to input taken into account; input of attenuation value via serial interface or keypad, range ±199.99 dB.

Reference Value Entry – Measured value on keystroke or value entered via interface or keypad.

Reference Impedance – 50 Ω/75 Ω, automatic/selectable.

Input/Output –
DC frequency input:
Connector: BNC female.
Input impedance: 9 MΩ.
Input voltage range: ±12 V, freely selectable, linear, scaling.
Maximum input voltage: 50 V.

DC Voltage Output:
Connector: BNC female.
Source impedance: 1 kΩ.
Output voltage (EMF): Proportional to pointer deflection.
Left-hand scale limit: Corresponding to 0 V.
Right-hand scale limit: Corresponding to 0 V.
Settling time: 250 ms.
Error: ≤5 mV.
Ripple: 5 mV p-p typical.

Remote Control – All device functions controlled via serial interface (V.24, RS-232C).

POWER REQUIREMENTS (URV 5 AND URV 35)
Battery Operation (URV 35 Model 02) –
Battery type: 5 LR20 (1.5 V).
Operating time: Approximately 125 hours.
Charge time (with UZ-35 charger): Approximately 24 hours.

AC Operation (URV 5 and URV 35 Model 03) –
Line voltage: 100/120/220/240 V AC ±10%.
Line frequency: 47 to 63 Hz, 400 Hz.
Power consumption: 30 VA.

ENVIRONMENTAL CHARACTERISTICS (URV 5 AND URV 35)
Temperature Range –
Operating: 0 to +50°C (Class I to IEC 359, no condensation).
Storage: –40 to +70°C.

Humidity – 80% maximum (without condensation).

Mechanical Strength – To IEC 359, Class I.

RFI Suppression – VDE 0871, DBP approval number to regulations 527/1979.

EMC – To IEC 801.3, severity level 3; MIL-STD-461-B RS 03 and CS 02.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	103	4.1
Width	219	6.6
Depth	240	9.4
Weight	**kg**	**lbs.**
Model 02		
With batteries	3.1	6.8
Without batteries	2.3	5.1
Model 03	2.4	5.3

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

URV 5
RF Millivoltmeter.
Includes: Power Cord, Manual.
Opt. 01 – DC Output.

URV 35 MODEL 02
RF Millivoltmeter (Battery Operated).

URV 35 MODEL 03
RF Millivoltmeter (AC Supply).
Includes: Power Cord, Manual.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

RECOMMENDED ACCESSORIES – Also see page 438.
Battery Charger – Order UZ-35.
Service Kit – Order URV 35-Z1.
Transit Case – Order UZ-22.
Carrying Strap – Order ZZT-96.
Rack Adapter – Order ZZA-97.
Plastic Hood – *1.
Probes and Sensors – See page 216.
1 Contact your local Tektronix representative.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters
NAS

Features

NAS

- Ideal for Measuring Power and SWR of All Kinds of Radio Equipment
- Plug-on Insertion Units for All Fields of Mobile Radio and for Power up to 1200 W
- Insertion Units for Digital Radio Networks (TDMA, GSM, DCS 1800, DCS 1900)
- Simultaneous Display of Forward and Reflected Power or of Forward Power and SWR
- Auto-ranging for Easy Operation
- Auto-calibration for Accurate Measurements
- Battery Operation for Measurements Anywhere
- Automatic Switchoff for Extended Battery Life
- Self-test for Reliable Operation

Applications

- TDMA
- GSM
- DCS 1800 (PCN)
- PCS 1900

NAS Directional Power Meter

With a frequency range from 1 MHz to 2000 MHz, the NAS Directional Power Meter covers from shortwaves to digital radio network frequencies. Six Insertion Units provide full coverage for the entire range.

NAS INSERTION UNITS

Insertion Units plug into the side of the NAS. They can also be connected via a 1.5-meter cable for measurements at test points that are difficult to reach. Specific calibration data is stored in each Insertion Unit. The NAS factors this data into measurements so the correct values at the measurement point are indicated on the front-panel meters. Selecting the appropriate Insertion Unit allows measurements from 1 MHz to 1800 MHz at power ratings from 0.01 to 1200 watts. This allows the NAS to make measurements on shortwave radios, police and fire radios, aircraft radios, TDMA transceivers, GSM, DCS 1800 (PCN), and cordless telephones.

TERMINATED POWER MEASUREMENTS

The NAS can also be used for terminated power measurements. For measurements of transmitters, a termination, which acts as a dummy antenna, is connected to the output of the Insertion Unit. Two termination units are available with load-handling capacity up to 30 watts.

MEASUREMENTS ON TDMA TRANSCEIVERS

The frequency range and circuit design of the NAS-Z6 and NAS-Z7 Insertion Units have been specifically tailored for measurements on GSM transceivers. TDMA signals call for special measurement techniques, since digital transmissions employ clocked signals and no CW signals are available for measurement. Conventional directional power meters indicate varying average power values depending upon the weighting method chosen. It's difficult to draw accurate conclusions regarding the true emitted power or on matching from these measurements. In order to obtain accurate results, the NAS makes a PEP (Peak, Envelope, Peak) measurement of the clocked signal, with due consideration of network timing. In addition, the NAS-Z6 and NAS-Z7 Insertion Units contain special circuitry to eliminate overshoots on signal bursts which make measurement impossible with conventional directional power meters.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters
NAS

Characteristics

BASIC UNIT

Display – Two moving-coil meters for forward and reflected power or forward power and SWR.

Power Measurement Ranges –
With NAS-Z7: 0.3/1/3/10/30 W.
With NAS-Z1, NAS-Z3, NAS-Z5, NAS-Z6: 0.3/1/3/10/30/100 W.
With NAS-Z2: 3/10/30/100/300 W.

Range Selection – Automatic or manual, separate for forward and reflected power.

Error Limits (18 to 28°C) – ±1.5% of selected range + error of insertion unit.

Additional Error at Temperatures >28°C or <18°C – ≤0.25% of reading/°C.

Automatic Switchoff – Approximately one hour after last keystroke.

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range – 0 to 50°C.

POWER SUPPLY

Battery Type – Five dry batteries, IEC R20 (alkaline-manganese batteries).

Lifetime – >150 hours.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	210	8.3
Height	145	5.7
Depth	90	3.5
Weight	**kg**	**lbs.**
(without Insertion Units)	2	4.4

FOR ALL INSERTION UNITS

Connector – N, female.

Characteristic Impedance – 50 Ω.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	55	2.2
Height	120	4.7
Depth	90	3.5
Weight	**kg**	**lbs.**
Net	0.7	1.5

TERMINATIONS

Load-handling Capacity –
Continuous: NAZ10: 10 W; NAZ30: 30 W.
For 1 minute: NAZ10: 15 W; NAZ30: 50 W.

Impedance – 50 Ω.

Frequency Range –
NAZ10: 0 to 1 GHz.
NAZ30: 0 to 2 GHz.

SWR –
NAZ10: ≤1.15.
NAZ30: To 1 GHz: ≤1.1; To 2 GHz: ≤1.2.

Connector – N, male.

INSERTION UNITS

Model	NAS-Z1	NAS-Z2	NAS-Z3	NAS-Z5	NAS-Z6	NAS-Z7
Frequency Range	1 to 30 MHz	1 to 30 MHz	25 to 200 MHz	70 to 1000 MHz	890 to 960 MHz*1	890 to 960 MHz, 1710 to 1880 MHz*1
Measurement Range	0.01 to 120 W	0.1 to 1200 W	0.01 to 120 W	0.01 to 120 W	0.01 to 120 W	0.01 to 30 W*2
Error Limits	±4.5% of reading	±6.5% of reading	±5.5% of reading	–	±5.5% of reading	±6.0% or reading (≤20 W), ±7.0% of reading (20 to 30 W)
100 to 1000 MHz	–	–	–	±6.5% of reading	–	–
75 to 100 MHz	–	–	–	–11 to +5.5% of reading	–	–
70 to 75 MHz	–	–	–	–15 to +5.5% of reading	–	–
SWR	<1.07	<1.07	<1.07	–	<1.1	<1.15
<500 MHz	–	–	–	<1.07	–	–
≥500 MHz	–	–	–	<1.1	–	–
Directivity	>30 dB	>30 dB	>30 dB	–	>26 dB	>26 dB
<500 MHz	–	–	–	>30 dB	–	–
≥500 MHz	–	–	–	>26 dB	–	–
Insertion Loss	<0.2 dB	<0.1 dB	<0.2 dB	<0.3 dB	<0.3 dB	<0.3 dB

**1 Useful frequency range for CW signals: 100 to 1000 MHz for NAS-Z6, 850 to 2000 MHz for NAS-Z7 (with higher error limits).*

**2 Up to 100 W with higher error limits.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

NAS
Directional Power Meter.
Includes: Instruction Manual.

MEASUREMENT SERVICE OPTIONS

Call your local Tektronix representative for a full list of service options.

RECOMMENDED ACCESSORIES

See Power Sensors, Probes, and RF Insertion Units table, page 216.

Connecting Cable – 1.5 m for detached operation of Insertion Units. Order NAS-Z9.

Carrying Bag – Order NAZ10.

10 W Termination – Order NAZ10.

30 W Termination – Order NAZ30.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters
New NAP

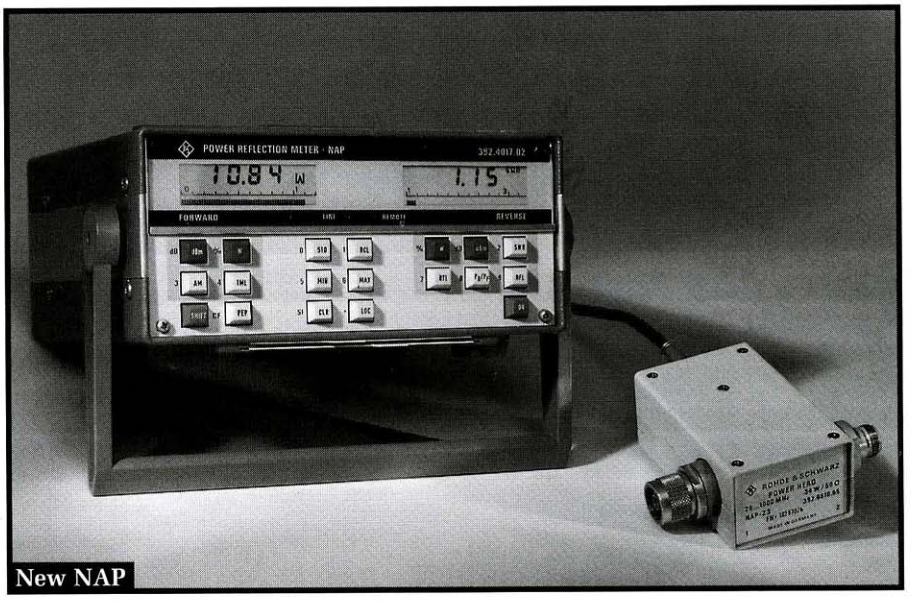
Features

NAP

- Plug-on Power Sensors for Measurements up to 1950 W
- Digital Readout with Analog Bargraph
- Dual Power Operation – Batteries or AC Line
- GPIB Programmable Operation (optional)

Applications

- Power Measurement on Transmitters, Amplifiers, and Industrial RF Generators
- Power Monitoring on Antenna Feeders
- Measurement of Sync Pulse Power of TV Transmitters up to 195 W
- Power Measurement on GSM Base and Mobile Stations



New NAP

NAP Power Reflection Meter

The NAP Power Reflection Meter is the ideal instrument to measure incident or reflected power wherever it occurs. With dual digital and analog displays, it provides accurate measurements even in hard to reach locations in the field, in the lab, or in the industrial plant.

RELIABLE MEASUREMENTS AT HIGH RF POWER
The NAP Power Reflection Meter is the right instrument to measure high RF power no matter where it's produced. Whether it's emitted by radio equipment or by high-power generators in industrial or medical equipment, it has to be accurately measured.

The NAP is equally at home in the field, in the lab, or installed in a measurement system. It can be operated from internal batteries or an AC line.

THE RIGHT SENSOR FOR EVERY APPLICATION
Directional power meters are inserted into the line between source and load to determine the power of the incident or reflected wave. The actual measurement is made by a detachable directional coupler, or sensor. The sensors available for the NAP cover a wide variety of frequency bands from maritime radio frequencies through digital GSM. at powers from milliwatts up to 2 kW. High immunity to radiated emissions allows measurements to be made even in the near field of transmitting antennas. The cable-mounted sensors allow measurements to be made in areas inaccessible to built-in measuring units.

Power sensors available for the NAP can measure the average power of modulated or unmodulated signals. They can measure Peak Envelope Power (PEP) in addition to peak power of amplitude-modulated or pulsed RF signals.

SINGLE-FUNCTION KEYS FOR EASE OF OPERATION
Almost all functions can be directly selected with a single key. The direction of power flow through the sensor is absolutely irrelevant. Incident and reflected power are not assigned to a fixed physical channel, but to the direction with the higher or lower power.

The NAP features a variety of special functions, such as range hold and zeroing. Calibration factors can be entered to enhance measurement accuracy.

DUAL DISPLAYS WITH DIGITAL AND ANALOG READOUT
Two separate LCDs provide clear display of incident and reflected power. These digital readouts are complemented by two fast analog bargraph indicators which continuously track changes in the measured values. DC voltages proportional to the measured incident and reflected power are available at rear-panel outputs.

Characteristics

NAP DISPLAY UNIT
Power Measurement Ranges – 1/10/100% of maximum sensor power, automatic or manual setting.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters
New NAP

Power Sensor Connector – 15-contact to DIN 41652.

Functions Displayed –
Incident/reflected power in W or dBm.
SWR.
Reflection coefficient in %.
Mismatch and return loss in DB.
Reflected/incident power ratio in %.
Modulation depth with AM in % (30 Hz to 20 kHz).
Relative measurements in % or dB.
Minimum/maximum values.
Average power or peak envelop power (PEP).

Readout –
Digital Display: 3 1/2 digits.
Analog Display: Bar with 56 scale divisions.

Measurement Time (without range switchover) –
Digital Value:
Manual: 400 ms.
Via IEEE bus: 400 ms (NAP-Z3 to Z6, Z9), 500 ms (NAP-Z7/Z8/Z10/Z11 in AVG mode), 1500 ms (NAP-Z7/Z8/Z10/Z11 in PEP mode).

Analog Value:
AC operation: 80 ms.
Battery operation: 400 ms/80 ms (selectable).

Analog Outputs –
Channels: Incident and reflected channel.
Connectors: 4-mm sockets.
EMF: 1 mV/1 digit of display.
Error: <±20 mV.
Output Impedance: 2.2 kΩ.

REMOTE CONTROL (WITH OPTION 04)
Standard – IEEE 488 (IEC625).

Connector – 24-contact Amphenol.

Functions – SH1, AH1, T6, L4, SR1, RL1, DC1, DT1.

ENVIRONMENTAL
Temperature Range –
Operating: 0°C to 50°C (to IEC 68-2-1).
Storage: –40°C to +70°C (to IEC 68-2-2).

Humidity – 95%, +25° C/+40°C (to IEC 68-2-30).

Vibration –
Sinusoidal: To IEC 68-2-6, IEC 1010-1, and VG 95332, sheet 24, degree of severity A2, 10 to 55 Hz, maximum 2 g.
Noise Spectrum: To IEC 68-2-36, 10 to 300 Hz.

Shock – 40 g, shock spectrum to IEC 68-2-27 or MIL-STD-810D.

Electromagnetic Compatibility –
To EN 50081-1 (EC EMC directives), VDE o875 RFI suppression grade K and MIL-STD-461C, test CE 03, RE 02, and RS 03 (at higher field strengths 20 V/m.)

POWER SUPPLY
Battery –
NAP02: Six 1.5 V LR 20 dry batteries. Up to 400 hours operating life with alkaline batteries.
NAP04 (or NAP02 with Opt. 04): Five 1.2 V NiCd rechargeable cells. Up to 100 hours operation from full charge.

AC Supply –
Line Voltage: 100 to 120 VAC, 220 to 240 VAC, ±10%.
Line Frequency: 47 to 63 Hz.
Power Consumption: 14 VA.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	110	4.33
Width	241	9.48
Depth	219	8.62
Weight	**kg**	**lbs.**
Net	3.6	8

POWER SENSORS

	NAP-Z3	NAP-Z4	NAP-Z5	NAP-Z6	NAP-Z7	NAP-Z8	NAP-Z9	NAP-Z10	NAP-Z11
Frequency Range	25 MHz to 1 GHz	25 MHz to 1 GHz	25 MHz to 1 GHz	25 MHz to 1 GHz	0.4 to 80 MHz	0.2 to 80 MHz	100 MHz to 1 GHz	35 MHz to 1 GHz*1	35 MHz to 1 GHz*1
Power Measurement Range	0.02 to 35 W	0.05 to 110W	0.2 to 350 W	0.5 to 1100 W	0.1 to 195 W	1 to 1950 W	1 mW to 1.1 W	0.01 to 19.5 W	0.1 to 195 W
Parameter Measured	AVG Power	AVG Power Power	AVG Power Power	AVG Power Power	AVG Power and PEP*2	AVG Power and PEP*2	AVG Power	AVG Power and PEP*2	AVG Power and PEP*2
Directivity*3	≥30dB (30 MHz to 1 GHz)	≥30dB (30 MHz to 1 GHz)	≥30dB (30 MHz to 1 GHz)	≥30dB (30 MHz to 1 GHz)	≥30dB (30 MHz to 80 MHz)	≥30dB (30 MHz to 80 MHz)	≥30dB (170 MHz to 1 GHz)	≥30dB (40 MHz to 1 GHz)	≥30dB (40 MHz to 1 GHz)
SWR ≤1.25 Measurement	5% typical	5% typical	5% typical	5% typical	4% typical (1.5 to 30 MHz)	4% typical (1.5 to 30 MHz)	5% typical	5% typical	5% typical
Error ≤2	8% typical	8% typical	8% typical	8% typical	5% typical	5% typical (1.5 to 30 MHz)	8% typical (1.5 to 30 MHz)	8% typical	8% typical
Order:	**NAP-Z3**	**NAP-Z4**	**NAP-Z5**	**NAP-Z6**	**NAP-Z7**	**NAP-Z8**	**NAP-Z9**	**NAP-Z10**	**NAP-Z11**

**1 890 to 960 MHz for NAP04. *2 PEP = Peak Envelope Power. *3 Refer to data sheet for directivity at other frequencies.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

NAP02
Power Reflection Meter (Battery Operation).

NAP04
Power Reflection Meter (Rechargeable Batteries, AC Supply (with power cord), IEEE Interface).
Includes: Operating Manual.

NAP OPTIONS
Opt. 04/NAP-B4 (NAP02) – Rechargeable Batteries, AC Supply (with power cord), IEEE Interface.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

RECOMMENDED ACCESSORIES
25 m Extension Cable – Order NAP-Z2.
See Power Sensors table above.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Power Meters
NRVD

Features

NRVD

- DC to 26.5 GHz Frequency Range
- Two Independent Channels for Simultaneous Measurement
- Power, Level, and Voltage Measurements
- LCD Display with Variable Backlighting, Separate Digital Readout for Each Channel, Bar Graph Indicator
- Intelligent Measuring Heads – Just Plug Them in and Measure
- Autoranging
- Entry of Reference Values for Level and Attenuation
- Menu-guided Operation via Softkeys
- Storage of 20 Complete Instrument Setups
- Rear Connectors for Rack Mounting
- Built-in Test Generator for Checking Sensors
- Remote Control of All Functions via IEC/IEEE Bus

Applications

- Laboratory Test
- Production Test
- R & D

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987 with SCPI conformance.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

NRVD Dual-channel Power Meter

The NRVD Dual-channel Power Meter functions like two independent measuring instruments housed in one cabinet to perform measurements simultaneously and exchange data with one another. The two channels can be separately set so that two completely different measurements can be carried out at the same time. The two measured values can also be related to each other for direct indication of reflection coefficient, SWR and return loss, for instance, when an SWR bridge is connected to the meter.

READOUT OF RESULTS
Measurement results are displayed with selectable resolution on a large 5-digit LCD display with adjustable backlighting. The values measured in the two channels, or one measured value plus an additional item of information (e.g., the correction frequency) are displayed simultaneously.

All standard units of measurement or relative modes can be selected. Relative measurements are either referred to a stored reference value or to the value measured in the second channel. A high-resolution bar graph indicator with selectable scaling or autoscaling permits quasi-analog display of measured values with any unit or resolution.

If pulse-modulated signals are measured, the NRVD calculates the pulse peak power from the measured average value and the entered pulse duty factor, the result is directly displayed. In addition, the modulation depth of an amplitude-modulated signal can be determined from the power variation. After entering the SWR of the source, the measured value, together with its uncertainty, can be displayed.

MEASUREMENT RATE
The attainable measurement rate depends upon the type of measuring head used, as well as on the setting of the averaging filter, which must be matched to the measurement conditions. Taking into account the connected measuring head, the NRVD automatically selects the appropriate measurement rate by determining the optimum averaging time required for a steady readout as a function of level and selected resolution. This automatic selection may be disabled, and an averaging time of between 4 ms and 25 s may be set manually to measure more quickly than in automatic operation or to further reduce the noise.

POWER SENSORS
The range of probes and sensors includes thermocouple power sensors, as well as highly sensitive diode power sensors, probes, and insertion units. This allows the NRVD to cover a frequency range from DC to 26.5 GHz and a power span from 400 pW up to the kW range.

TEST GENERATOR
A test generator is included to check measuring heads and sensors for proper functioning. It generates a low-distortion, highly accurate 50-MHz signal of 1 mW power (0 dBm).

INPUT/OUTPUT WITH OPTION 01
Option 01 provides a number of inputs and outputs to extend the range of the NRVD.

Characteristics

Measurement Functions – Unmodulated and modulated power (average power, AM, pulse power), reflection, and DC voltage (depending upon measuring head).

Frequency Range – DC to 26.5 GHz (depending upon measuring head).

Level Range – 400 pW to 0.5 W (depending upon measuring head).

Measuring Heads – All NRV-Z and URV 5-Z voltage and power measuring heads.

Display – LCD with adjustable backlighting for figures, units, user prompting, and analog display.

Readout –
Absolute: W, dBm, V, dBV, dBµV.
Relative: dB, difference, %, ratio, referred to a stored reference value or to the second measurement channel; SWR, reflection coefficient, return loss in dB, modulation depth with AM; single-channel display; numeric readout of one channel and display of correction frequency or measurement error (not with all measuring heads) or dual-channel display, single-channel display, automatic, or with selectable scale.

Power Meters
NRVD

Resolution of Digital Display – 5 digits maximum, resolution adjustable in 3 modes.
HIGH: 12,000 steps or 0.001 dB.
MEDIUM: 1,200 steps or 0.01 dB.
LOW: 120 steps or 0.1 dB.

Display Filtering – Averaging over 1 to 512 readings for reducing the display noise; manual or automatic setting depending upon measurement range and resolution (see Table 1).

Display Noise – See measuring head specifications.

Measurement Rate – See Table 2.

Error Limits of Power Readout in W (without error of measuring head) –
18 to 28°C: 0.3% + 1 digit.
10 to 40°C: 0.8% + 1 digit.
0 to 50°C: 1.3% + 1 digit.

Zero Adjustment – Manual or via IEC/IEEE bus, duration approximately 4 s.

Frequency Response Correction – Stored frequency response of measuring head taken into account by numerical entry of test frequency (manually or via IEC/IEEE bus) or by applying a frequency-proportional DC voltage.

Attenuation Compensation – Attenuation or gain connected to input taken into account; entry of attenuation value (±200 dB) via keyboard or IEC/IEEE bus.

Reference Value – One reference value per channel for relative measurements; numeric entry via keyboard or IEC/IEEE bus, or use stored measured value or current value of second channel.

Reference Impedance – For conversion between voltage and power, automatic readout of reference impedance from data stored in the measuring head or numeric entry via keyboard or IEC/IEEE bus (for RF probe).

Remote Control – Control of all instrument functions via IEC 625/IEEE 488 interface.
Interface functions: SH1, AH1, T6, L4, SR1, RL1, DC1, DT1, PP0, PPI.

TABLE 1 – Automatic filter setting depending upon measurement rate.

Resolution	Filter Number						
HIGH 0.001 dB	11	9	7	7	7	7	7
MEDIUM 0.01 dB	9	7	3	3	3	3	3
LOW 0.1 dB	7	3	0	0	0	0	0
Sensors							
NRV-Z1, -Z3, -Z5, -Z6, -Z7	10 nW	100 nW	1 µW	10 µW	100 µW	1 mW	20 mW
NRV-Z2, -Z5, -Z8	1 µW	10 µW	100 µW	1 mW	10 mW	100 mW	500 mW
NRV-Z51, -Z52	10 µW	100 µW	1 mW	10 mW	100 mW	–	–
URV 5-Z2, -Z7	–	1 mV	10 mV	100 mV	1 V	10 V	–
URV 5-Z4	–	10 mV	100 mV	1 V	10 V	100 V	–

TABLE 2 – Measurement time in seconds (from trigger to output of first byte) depending upon filter setting.

Filter Number	0	1	2	3	4	5	6	7	8	9	10	11	12
NRV-Z1 to -Z8	0.045	0.05	0.06	0.08	0.15	0.27	0.49	0.95	1.85	3.6	7.2	14.5	28.5
NRV-Z51 to -Z52	0.115	0.12	0.13	0.15	0.21	0.32	0.52	0.92	1.75	3.4	6.6	13	26
URV 5-Z2, -Z4, -Z7	0.065	0.07	0.08	0.10	0.20	0.38	0.72	1.45	2.8	5.5	11	22	44

Test Generator –
Output power: 1.00 mW.
Frequency: 50 MHz.
Power measurement error: ≤0.7%.
SWR: ≤1.03.
RF connector: N female.

DC Control Input for Frequency Response Correction –
Connector: BNC female.
Input level: ±12 V, linear with selectable scale.
Input impedance: 9 MΩ.
Maximum input voltage: 50 V.

I/O with Option 01 –
Output: Two analog outputs for simultaneous output of measurement results of both channels.
Output impedance: 1 kΩ.
Voltage range: 0 to 3 V.
Resolution: 1 mV.
Error: ≤5 mV.

Input: DC input for analog frequency response correction.
Voltage range: ±12 V.
Input impedance: 1 MΩ.
Trigger input: TTL, active low.
Ready output: TTL, active high.

POWER REQUIREMENTS

Line Voltage – 110/120 V ±10%; 220 V ±10%, 230 V –6/+15%.

Line Frequency – 47 to 63 Hz.

Power Consumption – 25 VA.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range –
Operating: 0 to +50°C, to IEC 359, Class I.
Storage: –40 to +70°C.

RFI Suppression – DBP approval number to regulations 527/1979, VDE 0871.

EMC – IEC 801-3, severity level 3; MIL-STD-461-B; RS 03 and CS 02.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	147	5.8
Width	219	8.6
Depth	350	13.8
Weight	**kg**	**lbs.**
Net	4.5	9.9

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

NRVD
Dual-channel Power Meter.
Includes: Power Cable, Manual.

Opt. 01/NRVD-B2 – I/O Option.

MEASUREMENT SERVICE OPTIONS

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES

Also see page 438.

See Probes and Sensors, page 216.

Rack Adapter – Order ZZA-98.

Accessory Bag – Order ZZT-92.

Carrying Straps – Order ZZT-96.

Transit Case – Order ZZK-983.

Service Kit – Order NRVD-S1.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters
NRVS

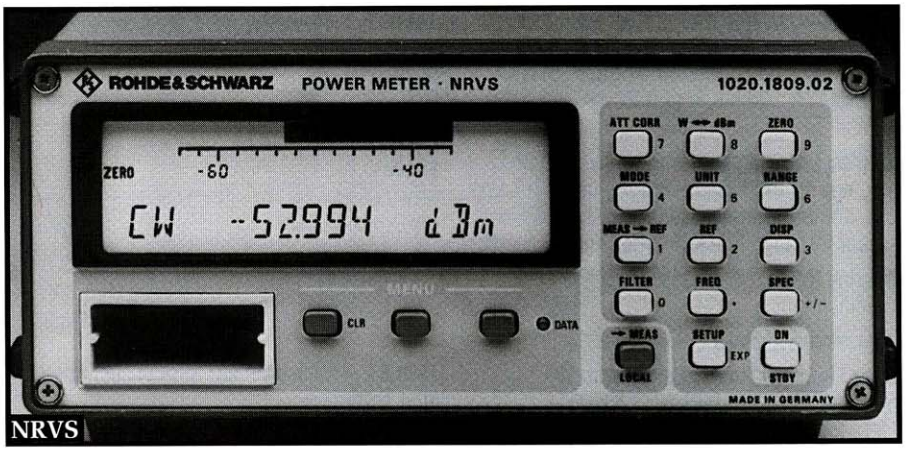
Features

NRVS

- DC to 26.5 GHz Frequency Range
- Power, Level, and Voltage Measurements
- Intelligent Measuring Heads – Just Plug Them in and Measure
- DC Frequency Input for Tracking Frequency-response Correction
- Analog Output
- Menu-guided Operation with Softkeys
- Storage of 20 Complete Instrument Setups
- 13 Digital Filters for Noise Suppression, Automatic or Manual Filter Selection
- Remote Control of All Functions via IEC/IEEE Bus

Applications

- Laboratory
- Production



NRVS

NRVS Power Meter

The NRVS Power Meter is the ideal instrument for any kind of power measurement in laboratory and system applications. Intelligent probes with calibration data memory and thermocouple sensors make user adjustments unnecessary. The NRVS provides high-precision measurements free of operator errors.

READOUT OF RESULTS

Measurement results, units, and various items of information are displayed on a large 4 1/2-digit LCD display in three steps of resolution. All standard units of measurement or relative modes can be selected. A high resolution bargraph indicator with selectable scaling or auto-scaling permits quasi-analog display of measured values with any unit of resolution.

If pulse-modulated signals are measured, the NRVS calculates the pulse peak power from the measured average value and the entered pulse duty factor; the result is directly displayed.

MEASUREMENT RATE

The attainable measurement rate depends upon the type of measuring head used as well as the setting of the averaging filter, which must be matched to the measurement conditions. Taking into account the connected measuring head, the NRVS automatically selects the appropriate measurement rate by determining the optimum averaging time required for a steady readout as a function of level and selected resolution. This automatic selection may be disabled and an averaging time of between 4 ms and 25 s set manually to measure more quickly than in automatic operation or to further reduce the noise.

POWER SENSORS

The range of probes and sensors includes thermocouple power sensors, as well as highly sensitive diode power sensors, probes, and insertion units. This allows the NRVS to cover a frequency range from DC to 26.5 GHz and a power span from 400 pW up to the kW range.

Characteristics

Measurement Functions – Average power, pulse power, DC voltage (depending upon measuring head).

Frequency Range – DC to 26.5 GHz (depending upon measuring head).

Level Range – 400 pW to 0.5 W (depending upon measuring head).

Measuring Heads – All NRV-Z and URV 5-Z voltage and power measuring heads.

Display – LCD for figures, units, user prompting, and analog display.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters
NRVS

Readout –
Absolute: W, dBm, V, dBµV.
Relative: dB, %W, or %V referred to a stored reference value, numeric readout with or without display of correction frequency.

Analog Display – Automatic or with selectable scale.

Resolution of Digital Display – 4 1/2 digits maximum, resolution adjustable in 3 modes.
HIGH: 12,000 steps or 0.001 dB.
MEDIUM: 1,200 steps or 0.01 dB.
LOW: 120 steps or 0.1 dB.

Averaging Filter – Over 1 to 512 readings for reducing the display noise; manual or automatic setting depending upon measurement range and resolution (see Table 1).

Display Noise – See measuring head specifications.

Measurement Rate – See Table 2.

Error Limits of Power Readout in W (without error of measuring head) –
18 to 28°C: 0.4% + 1 digit.
10 to 40°C: 0.9% + 1 digit.
0 to 50°C: 1.4% + 1 digit.

Zero Adjustment – Manual or via IEC/IEEE bus, duration approximately 4 s.

Frequency Response Correction – Stored frequency response of measuring head taken into account by numerical entry of test frequency (manually or via IEC/IEEE bus) or by applying a frequency-proportional DC voltage.

Attenuation Compensation – Attenuation or gain connected to input taken into account; entry of attenuation value (±200 dB) via keyboard or IEC/IEEE bus.

Reference Value – Numeric entry via keyboard or IEC/IEEE bus, or use stored measured value.

Reference Impedance – For conversion between voltage and power, automatic readout of reference impedance from data stored in the measuring head or numeric entry via keyboard or IEC/IEEE bus (for RF probe).

TABLE 1 – Automatic filter setting, depending upon measurement rate.

Resolution	Filter Number						
HIGH 0.001 dB	11	9	7	7	7	7	7
MEDIUM 0.01 dB	9	8	3	3	3	3	3
LOW 0.1 dB	7	3	0	0	0	0	0
Sensors							
NRV-Z1, -Z3, -Z4, -Z6, -Z7	10 nW	100 nW	1 µW	10 µW	100 µW	1 mW	20 mW
NRV-Z2, -Z5, -Z8	1 µW	10 µW	100 µW	1 mW	10 mW	100 mW	500 mW
NRV-Z51, -Z52	10 µW	100 µW	1 mW	10 mW	100 mW	–	–
URV 5-Z2, -Z7	–	1 mV	10 mV	100 mV	1 V	10 V	–
URV 5-Z4	–	10 mV	100 mV	1 V	10 V	100 V	–

TABLE 2 – Measurement time in seconds (from trigger to output of first byte), depending upon filter setting.

Filter Number	0	1	2	3	4	5	6	7	8	9	10	11	12
NRV-Z1 to -Z8	0.045	0.05	0.06	0.08	0.15	0.27	0.49	0.95	1.85	3.6	7.2	14.5	28.5
NRV-Z51 to -Z52	0.115	0.12	0.13	0.15	0.21	0.32	0.52	0.92	1.75	3.4	6.6	13	26
URV 5-Z2, -Z4, -Z7	0.065	0.07	0.08	0.10	0.20	0.38	0.72	1.45	2.8	5.5	11	22	44

Remote Control – Control of all instrument functions via IEC 625/IEEE 488 interface.
Interface functions: SH1, AH1, T6, L4, SR1, RL1, DC1, DT1, PP0.

DC Control Input for Frequency Response Correction –
Connector: BNC female.
Input level: ±12 V, linear with selectable scale.
Input impedance: 9 MΩ.
Maximum input Voltage: 50 V.

DC Output –
Connector: BNC female.
Source impedance: 1 kΩ.
Output voltage (EMF): Proportional to deflection of analog display.
Full scale value: Left 0 V, right +3 V.
Additional settling time: 250 ms.

POWER REQUIREMENTS

Line Voltage – 115 V +15/–22%; 230 V +15/–22%.

Line Frequency – 47 to 63 (440) Hz.

Power Consumption – 13 VA.

Safety – Class I to VDE 0411 and IEC 348, transformer with thermal overload protection.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range –
Operating: 0 to +50°C, for use in Class I to IEC 359.
Storage: –40 to +70°C.

Humidity – To 80% (without dewing).

Mechanical Stability – IEC 359, Class I.

RFI Suppression – DBP approval number to regulations 527/1979, VDE 0871.

EMC – IEC 801-3, severity level 3; MIL-STD-461-B; RS 03 and CS 02.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	103	4.1
Width	219	8.6
Depth	350	13.8
Weight	**kg**	**lbs.**
Net	3.2	7.1

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

NRVS
Power Meter.
Includes: Power Cord, Manual.

MEASUREMENT SERVICE OPTIONS

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES

Also see page 438.

See Probes, Sensors, and Insertion Units, page 216.

Rack Adapter – Order ZZA-97.

Accessory Bag – Order ZZT-92.

Carrying Straps – Order ZZT-96.

Transit Case – Order ZZK-973.

Service Kit – Order NRVS-1.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

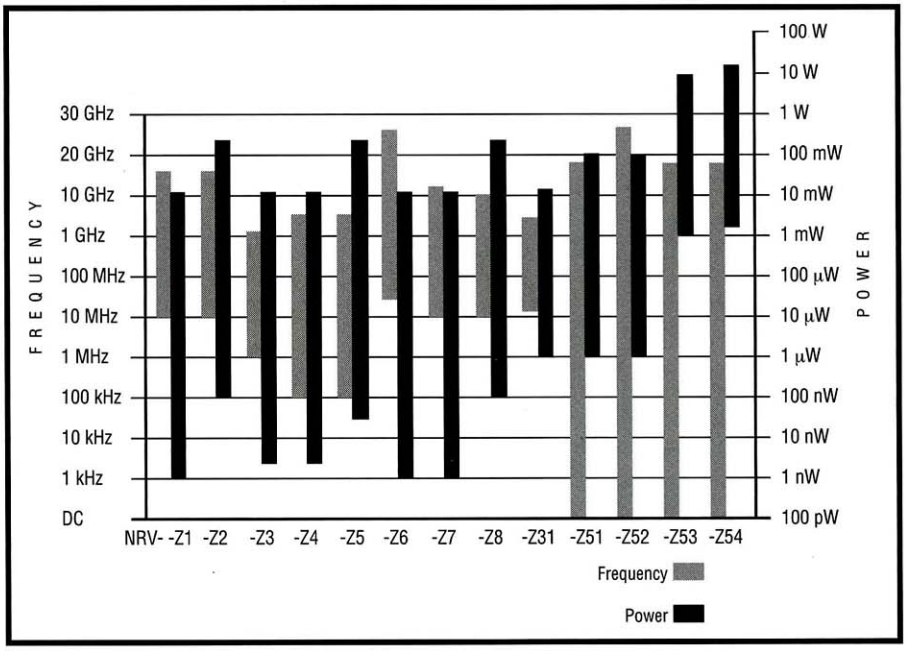
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters

Power Sensors • Probes • RF Insertion Units

Features

- Thermocouple Sensors
- Diode Sensors
- Diode Sensors with an Integral 20-dB Attenuator
- Peak Power Sensors
- RF Probes
- RF Insertion Units



Power Sensors for URV/NRV family.

A Full Range of Probes, Insertion Units, and Power Sensors

These probes, insertion units, and power sensors extend the measurement range and offer added measurement capability.

THE RIGHT SENSOR FOR EVERY APPLICATION

Power sensors absorb the power applied and provide an equivalent DC voltage at their output. To cover the complete power range from less than 1 nW to more than 100 mW, two different types of power sensors are required: thermocouple sensors based on the Seebeck effect, and semiconductor detectors using zero-bias Schottky diodes. Both types of transducers are available for the entire frequency spectrum.

THERMOCOUPLE SENSORS

Thermocouple sensors open up a wide power range from 1 µW to 100 mW. Regardless of the waveform, they always indicate the RMS power over the full range, giving precise results, even for modulated or complex signals.

DIODE SENSORS

Diode sensors feature a higher sensitivity. They are able to measure power to as low as 100 pW. Since they measure true RMS power down to 10 µW, they can even be used for signals with harmonic contents, noisy, or modulated signals.

DIODE SENSORS WITH AN INTEGRAL 20-DB ATTENUATOR

Diode sensors with an integral 20-dB attenuator fill the gap between pure diode sensors and thermocouples. They provide true RMS measurements in a range up to 1 mW and satisfy the most exacting requirements on measurement speed, even for levels between ten and 100 µW, where the use of thermocouple sensors is limited.

PEAK POWER SENSORS

Peak power sensors contain rectifiers for measuring the peak modulation. They enable direct measurement of the TV sync pulse peak power, the power of TDMA signals, as well as of other pulsed signals with a pulse width from 2 µs. In the frequency range from 1 µW to 20 mW, these sensors are a value-for-money alternative to special peak power meters.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Power Meters

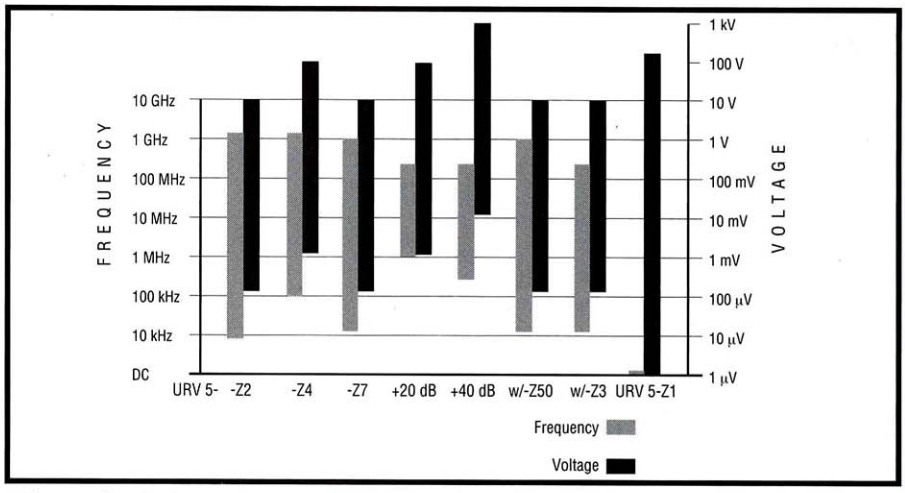
Power Sensors • Probes • RF Insertion Units

RF PROBES

RF probes are indispensable for measurements on non-coaxial circuits and components. Small input capacitance and low loss enable low-load measurements directly in the circuit. Dividers increase the voltage measurement range and minimize the loading of the device under test.

RF INSERTION UNITS

RF insertion units are used for voltage measurements in coaxial circuits. They incorporate a diode inserted in the inner conductor or connected via a piston attenuator and permit broadband measurements to be made up to 2 GHz with low reflection coefficient. Given matched conditions, these insertion units can also be used for practically no-loss measurements of RF power.



Voltage Probes for the URV/NRV family.

MEASURING HEADS

Probes

URV 5-Z1	DC Probe 0 to 400 V, 9 MΩ, 3 pF	For low-capacitance DC voltage measurements in RF circuits at minimum load
URV 5-Z702, 4 ft. cable URV 5-Z703, 16 ft. cable	RF Probe 200 µV to 10 V, 20 kHz to 1 GHz	For measurements in open RF circuits at low capacitance and resistive load
URV-Z6 with 20 dB plug-on divider*[1] URV-Z6 with 40 dB plug-on divider*[1]	2 mV to 100 V, 1 to 500 MHz 20 mV to 1000 V, 500 kHz to 500 MHz	The 20 dB and 40 dB plug-on dividers increase the voltage measuring range of the RF probe; the high Q factor of the capacitive divider makes the resistive loading negligible, the capacitive loading goes down to 0.5 pF (40 dB divider)
URV-Z50 with 50 Ω Adapter	200 µV to 10 V, 20 kHz to 1 GHz	With integrated termination for power or level measurements on test items, with a source impedance of 50 Ω in the frequency range up to 1 GHz (BNC female/male)
URV-Z3 with 75 Ω Adapter	200 µV to 10 V, 20 kHz to 500 MHz	With integrated termination for power or level measurements in 75 Ω systems, such as antenna or video assemblies (BNC male)

[1] Included in accessory URV-Z6.

RF Insertion Units (unless otherwise specified, all insertion units with N male/female; all power sensors with N male connectors)

URV 5-Z25, 4 ft. cable URV 5-Z26, 16 ft. cable	10 V Insertion Unit 50 Ω 200 µV to 10 V, 9 kHz to 2 GHz	Low-load RF voltage measurements in coaxial 50 Ω systems, low-loss power measurements on well-matched RF lines
URV 5-Z44, 4 ft. cable URV 5-Z45, 16 ft. cable	100 V Insertion Unit 50 Ω 2 mV to 100 V, 100 kHz to 2 GHz	Virtually no-load RF voltage measurements in coaxial 50 Ω systems even at higher voltages. Due to minimum insertion loss and reflection coefficient, this unit causes practically no interference on a 50 Ω line.
URV 5-Z46, 4 ft. cable URV 5-Z47, 16 ft. cable	100 V Insertion Unit 75 Ω 2 mV to 100 V, 100 kHz to 2 GHz	RF voltage measurements in coaxial 75 Ω systems, same performance as Insertion Unit URV 5-Z4/50 Ω
NAS-Z1	120 W Insertion Unit, 1 to 30 MHz	
NAS-Z2	1200 W Insertion Unit, 1 to 30 MHz	
NAS-Z3	120 W Insertion Unit, 25 to 200 MHz	
NAS-Z5	120 W Insertion Unit, 70 to 1000 MHz	
NAS-Z6	120 W Insertion Unit, 890 to 960 MHz	
NAS-Z7	30 W Insertion Unit, 890 to 960 MHz, 1710 to 1880 MHz	For GSM, DCS 1800

Power Meters

Power Sensors • Probes • RF Insertion Units

Power Sensors

NRV-Z1 02, 4 ft. cable NRV-Z1 03, 16 ft. cable	Diode Power Sensor 50 Ω 10 MHz to 18 GHz, 1 nW to 20 mW	Power measurements of highest sensitivity up to 18 GHz in 50 Ω systems
NRV-Z2 02, 4 ft. cable NRV-Z2 03, 16 ft. cable	Diode Power Sensor 50 Ω 10 MHz to 18 GHz, 100 nW to 500 mW	Power measurements with minimum mismatch, for high powers in 50 Ω systems
NRV-Z3 02, 4 ft. cable NRV-Z3 03, 16 ft. cable	Diode Power Sensor 75 Ω 1 MHz to 2.5 GHz, 400 pW to 13 mW	Power measurements in 75 Ω systems
NRV-Z4 02, 4 ft. cable NRV-Z4 03, 16 ft. cable	Diode Power Sensor 50 Ω 100 kHz to 6 GHz, 500 pW to 20 mW	Power measurements of highest sensitivity in the frequency range 100 kHz to 6 GHz, very large dynamic range
NRV-Z5 02, 4 ft. cable NRV-Z5 03, 16 ft. cable	Diode Power Sensor 50 Ω 100 kHz to 6 GHz, 50 nW to 500 mW	Like NRV-Z4, but for high powers and minimum mismatch
NRV-Z6	Diode Power Sensor 50 Ω 50 MHz to 26.5 GHz, 1 nW to 20 mW	Power measurements up to 26.5 GHz with high sensitivity in 50 Ω systems (PC 3.5 male)
NRV-Z7	Diode Power Sensor 50 Ω 10 MHz to 13 GHz, 1 nW to 20 mW	Like NRV-Z1, but only up to 13 GHz
NRV-Z8	Diode Power Sensor 50 Ω 10 MHz to 13 GHz, 100 nW to 500 mW	Like NRV-Z2, but only up to 13 GHz
NRV-Z31	Peak Power Sensor 50 Ω 30 MHz to 6 GHz, 1 µW to 20 mW	Peak power measurements, pulse width ≥2 (200) µs, pulse repetition rate ≥10 (100) Hz, 3 models
NRV-Z51	Thermocouple Sensor 50 Ω DC to 18 GHz, 1 µW to 100 mW	High-precision power measurements also with non-sinusoidal signals
NRV-Z52	Thermocouple Sensor 50 Ω DC to 26.5 GHz, 1 µW to 100 mW	Like NRV-Z51, but with PC 3.5 connector for measurements up to 26.5 GHz
NRV-Z53	Thermocouple Sensor 50 Ω DC to 18 GHz, 100 µW to 10 W	High-power measurements up to 10 W also with non-sinusoidal signals
NRV-Z54	Thermocouple Sensor 50 Ω DC to 18 GHz, 300 µW to 30 W	High-power measurements up to 30 W also with non-sinusoidal signals

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

PROBES

DC Probe – Order URV 5-Z1.

RF Probe – Order URV 5-Z7.

RF Probe with 20 dB and 40 dB Plug-on Divider – Order URV-Z6.

RF Probe with 50 Ω Adapter – Order URV-Z50.

RF Probe with 75 Ω Adapter – Order URV-Z3.

RF INSERTION UNITS

10 V Insertion Unit, 50 Ω – Order URV 5-Z2.

100 V Insertion Unit, 50 Ω – Order URV 5-Z44.

100 V Insertion Unit, 75 Ω – Order URV 5-Z47.

120 W Insertion Unit, 1 to 30 MHz – Order NAS-Z1.

1200 W Insertion Unit, 1 to 30 MHz – Order NAS-Z2.

120 W Insertion Unit, 25 to 200 MHz – Order NAS-Z3.

120 W Insertion Unit, 70 to 1000 MHz – Order NAS-Z5.

120 W Insertion Unit, 890 to 960 MHz – Order NAS-Z6.

30 W Insertion Unit, 890 to 960 MHz, 1710 to 1880 MHz – Order NAS-Z7.

POWER SENSORS

Diode Power Sensor, 50 Ω – Order NRV-Z1.

Diode Power Sensor, 50 Ω – Order NRV-Z2.

Diode Power Sensor, 75 Ω – Order NRV-Z3.

Diode Power Sensor, 50 Ω – Order NRV-Z4.

Diode Power Sensor, 50 Ω – Order NRV-Z5.

Diode Power Sensor, 50 Ω – Order NRV-Z6.

Diode Power Sensor, 50 Ω – Order NRV-Z7.

Diode Power Sensor, 50 Ω – Order NRV-Z8.

Peak Power Sensor, 50 Ω – Order NRV-Z31.

Thermocouple Power Sensor, 50 Ω – Order NRV-Z51.

Thermocouple Power Sensor, 50 Ω – 1 µW to 100 mW, DC to 26.5 GHz. Order NRV-Z52.

Thermocouple Power Sensor, 50 Ω – Order NRV-Z53.

Thermocouple Power Sensor, 50 Ω – Order NRV-Z54.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Generators

Introduction

Signal generators are the primary stimulus tool in testing a wide range of components and systems used in wireless communication networks and RF/Microwave products. Tektronix offers a wide variety of signal generators to meet your changing needs. Generators with performance for digital modulated signals as well as analog formats, over the range of 9 kHz to 40 GHz are available.

Whether your needs are excellent phase noise, low spurious output, flexible digital modulation or high value, the signal generators from Tektronix offer you the right solution.

SIGNAL SOURCES OFFERED

SMIQ 02/03 Vector Signal Generator

300 kHz to 3.3 GHz, IQ inputs, flexible digital modulation, CDMA capability, fading simulation.

SME 02/03/03E/06 Digital Signal Generator

5 kHz to 6 GHz, digital signals for most wireless communication formats, four models cover from 5 KHz to 6 GHz.

SMHU58 Signal Generator

100 kHz to 4.32 GHz with high signal purity and frequency agility. For all types of digital and analog modulation.

IQSIM Software

Software tool for creating all types of digital modulation.

SME – K2

Software tool for generation of TDMA signals with the SME series generators.

SMT 02/03/06

5 kHz to 6 GHz multipurpose RF generators with analog modulation.

SMY 01/02

9 kHz to 2 GHz versatile, low cost, easy to use units for general purpose and production.

SMP 02/03/04/22

10 MHz to 40 GHz with high signal purity and output power for microwave system testing.

CONTENTS

DIGITAL GENERATOR GUIDE

SMIQ 220
SME 02/03/03E/06 224
SMHU 226
SME-K2 Software 229
IQSIM Software 230

ANALOG GENERATOR GUIDE

SMT 02/03/06 233
SMY 01/02 234

MICROWAVE GENERATOR GUIDE

SMP 02/03/04/22 231
Related Products 231

MIXED SIGNAL SOURCES

AWG 2041 394
AWG 2021 396
AWG 2005 398

LOGIC SOURCES

HFS 9003 401
HFS 9009 401
DG 2020 404

Signal Generators
New SMIQ

Features

SMIQ

- Frequency Range
  300 kHz to 3.3 GHz (SMIQ03)
  300 kHz to 2.2 GHz (SMIQ02)
- Broadband Analog I/Q Inputs
- NADC, GSM, PHS, CDMA Digital Modulation Formats (optional)
- Superior Modulation Accuracy and Stability
- Wideband AM
- Excellent Spectral Purity
- High Level Accuracy
- Frequency and Phase Modulation (optional)
- Fading Simulator in Conformance to Communications Systems Specifications (optional)
- Universal Modulation Coder for Custom-Designed Digital Modulation (optional)

Applications

- Wireless Component Design and Test
- Manufacturing Test
- Mobile Phone Design and Test
- Base Station Design and Test
- Digital Video Component and System Design, Test

New SMIQ Vector Signal Generator.

SMIQ Vector Signal Generator

The new SMIQ Vector Signal Generator covers a frequency rage from 300 kHz to 3.3 GHz. With superior modulation accuracy and excellent spectral purity, the SMIQ sets a new standard in the signal generator field for digital modulation applications.

The built-in I/Q modulator with a bandwidth of 30 MHz guarantees the highest modulation quality and versatility for all digital modulation formats for all in-channel and out-of-channel applications.

HIGH SPECTRAL PURITY

The SMIQ series offers the needed high spectral purity for demanding digital modulation and analog modulation applications. They provide the spectral purity required for sensitivity measurements or adjacent channel selectivity measurements.

SUPERIOR VECTOR ACCURACY OVER THE COMPLETE FREQUENCY RANGE

Making measurements of digital receivers with minimal measurement uncertainty requires a test source with excellent vector accuracy. The SMIQ generator provides superior precision of the I/Q modulator over the entire frequency range.

SIGNAL GENERATION FOR DIGITAL STANDARDS

With options SMIQ-B10 and SMIQ-B11, setup of PHS, GSM and NADC signals is automatic. Data frames and time slots can be easily edited with a graphical interface. Power ramping, symbol rate and baseband filtering can be varied for design limit testing.

CDMA signals for IS-95 testing are provided with option SMIQ-B42. Forward and reverse link signals are included for base station or mobile unit signals.

FADING SIMULATION FOR DIGITAL WIRELESS APPLICATIONS

A unique feature of the SMIQ series is the fading simulation in conformance to communication standards. The fading options add six- or twelve-path functionality for one or two RF channels. Recommended fading statistics such as Rayleigh, Rice, and Log Normal are also provided as standard settings which characterize the environmental situation.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987 with SCPI 1993.0.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Generators
New SMIQ

Characteristics

FREQUENCY RELATED
Frequency –
Range:
SMIQ03: 300 kHz to 3.3 GHz.
SMIQ02: 300 kHz to 2.2 GHz.
Resolution: 0.1 Hz.
Setting Time (to within $<1 * 10^{-7}$ for f > 450 MHz and < 240 Hz for f < 450 MHz):
After receipt of last character from IEC/IEEE bus: <15 ms.
After a trigger event in the List-Mode: <500 µs.
Phase Offset: Adjustable in steps of 1°.

Reference Frequency –
Aging (after 30 days of operation)
Standard: $1 * 10^{-6}$/year.
Option 01: $<1 * 10^{-9}$/day
Temperature effect (0 to +50° C):
Standard: $2 * 10^{-6}$.
Option 01: $<5 * 10^{-8}$.
Warm-up Time: Option 01: 15 minutes.
Output for Internal Reference:
Frequency: 10 MHz.
Level (EMF, sinewave): 1 V_{RMS}.
Source impedance: 50 Ω.
Input for External Frequency:
Frequency: 10 MHz.
Input level: 0.1 to 2 V_{RMS}.
Input impedance: 200 Ω.
Electronic Tuning (EXT. TUNE): $1 * 10^{-7}$/V.
Input voltage range: 0 to ±10 V.
Input impedance: 10 kΩ.

SPECTRAL PURITY
Spurious Signals –

Harmonics (level ≤10 dBm): <–30 dBc.
Non-harmonics:
CW, offset > 10 kHz from carrier:
0.3 to 450 MHz: <–74 dBc.
>450 to 1500 MHz: <–80 dBc.
>1500 to 3000 MHz: <–74 dBc.
>3000 MHz: <–60 dBc.
Vector modulation (0.3 to 3300 MHz):
Offset 10 kHz to 300 MHz from carrier:
<–70 dBc.
Offset ≥300 MHz from carrier: <–60 dBc.

Broadband Noise –
CW at >5 MHz from carrier:
f > 20 MHz: <–135 dBc (–140 dBc typical).
f > 3000 MHz: <–130 dBc (–135 dBc typical).
Vector modulation at >5 MHz from carrier:
f > 20 MHz: <–130 dBc (–135 dBc typical).

SSB Phase Noise (20 kHz from carrier at 1 Hz bandwidth) –

	CW	Vector Modulation
20 to 450 MHz	<–116 dBc	<–119 dBc
1000 MHz	<–126 dBc	<–123 dBc
2000 MHz	<–120 dBc	<–120 dBc
3000 MHz	<–116 dBc	<–116 dBc

Residual FM, RMS (f = 1 GHz) –
0.3 to 3 kHz (CCITT): <1 Hz.
0.03 to 20 kHz: <4 Hz.

Residual AM, RMS – 0.03 to 30 kHz: <0.02%.

LEVEL RELATED
Range – –140 to +13 dBm peak envelope power.

Overrange – Up to 16 dBm (typical).

Resolution – 0.1 dB.

Total Error (for Levels >–127 dBm) –
f < 2 GHz: <±1.0 dB.
f > 2 GHz: <±1.5 dB.

Level Flatness (at 0 dB) – <1 dB, 0.3 dB typical.

Output Impedance – 50 Ω.

VSWR (level > 0 dBm) – <2.

Setting TIme (IEC/IEEE bus) –
CW, Analog Modulation: <25 ms.
With Electronic Level Setting: <10 ms.

Non-interrupting Level Setting –
Setting range 0 to 25 dB.

OVERVOLTAGE PROTECTION
Protects the unit from externally applied RF power (50 Ω source) and DC voltages.

Maximum RF Power – 50 W.

Maximum DC Voltage – 35 V.

INTERNAL MODULATION GENERATOR
Frequency –
Range: 0.1 Hz to 1 MHz.
Resolution: 0.1 Hz.
Error: $<1 \times 10^{-4}$.
Sinewave Response: Up to 100 kHz: <0.4 dB.
Up to 1 MHz: <2 dB.

Distortion (20 Hz to 100 kHz) – <2 dB.

Output –
Open-circuit Voltage (R_L > 200 Ω):
1 mV_{peak} to 4 V_{peak}.
Output Impedance: Approx. 10 Ω.
Frequency setting time (after receipt of last character from IEC/IEEE bus): <10 ms.

AMPLITUDE MODULATION *1
Operating Modes – Internal, external AC/DC.

Modulation Depth (modulation depths meeting AM specifications linearly decrease on increasing the level from 7 to 13 dBm; a status message will be output if the modulation depth is too great) – 0 to 100%.

Resolution – 0.1 %.

Setting Error at 1 kHz (m < 80%) –
<4% of reading ±1%.

AM Distortion at 1 kHz –
m = 30%: <1%.
m = 80%: <2%.

Modulation Frequency Range – DC to 50 kHz.

Modulation Frequency Response (m = 60%) –
20 Hz to 20 kHz: <1 dB.

Incidental φM with 30% AM, AF = 1 kHz –
<0.1 rad.

EXT1 MODULATION INPUT
Input Voltage for Selected Modulation Depth – 1 V_{peak}.

High/low Indication – For inaccuracy >3%.

Input Impedance – >100 kΩ.

BROADBAND AMPLITUDE MODULATION (BB-AM)*2
Operating Mode – External DC.

Modulation Frequency Response –
DC to 10 MHz: ≤1 dB.
DC to 30 MHz: <3 dB.

BB-AM Modulation Input –
Input Voltage for 100% Modulation Depth:
0.25 V_{peak}.
Input Impedance: 50 Ω.

VECTOR MODULATION*2
Operating Mode – External.

I and Q Modulation Inputs –
Input Voltage for Full Scale Magnitude
(1 V EMF, 50 Ω source): $\sqrt{I^2 + Q^2} = 0.5$ V.
Input Impedance: 50 Ω.

Error Vector Magnitude (16 QAM, symbol rate 10 kHz, output level ≤7 dBm peak envelope power) – <0.7% RMS, < 1.5% peak[3].

Residual Carrier (0 V Input Voltage, related to full scale) – <–45 dBc.

Signal Generators
New SMIQ

I/Q Impairment –
Carrier Leakage:
Setting range: 0 to 50%.
Resolution: 0.5%.
I ≠ Q:
Setting range: –12 to +12%.
Resolution: 0.1%.
Quadrature offset:
Setting range: –10 to +10°.
Resolution: 0.1°.

ANALOG ENVELOPE CONTROL
Linear Range – 0 to –30 dB (–35 dB typical).

Attenuation Error (at –20 dB) – <0.5 dB.

On/Off Ratio – >80 dB.

Delay Time – 1 µs typical.

Rise/Fall Time (10/90%) – <1 µs.

External Input – POW RAMP.

FREQUENCY MODULATION (WITH OPT. 05)
Operating Modes – Internal, External AC/DC, Two tone with two separate channels FM 1 and FM2.

Maximum Deviation –
Without I/Q Modulation:
0.3 to 450 MHz: 2 MHz.
>450 to 750 MHz: 0.5 MHz.
>750 to 1500 MHz: 1 MHz.
>1500 to 3300 MHz: 2 MHz.
With I/Q Modulation:
0.3 to 750 MHz: 2 MHz.
>750 to 1200 MHz: 1 MHz.
>100 to 3300 MHz: 2 MHz.

Resolution – <1% minimum (10 Hz).

Setting Error (AF = 1 kHz) – <3% of reading + 20 Hz.

FM Distortion (AF = 1 kHz, half max. deviation) – <0.5%

Modulation Frequency Range –
Maximum deviation: DC to 500 kHz.
<25% max. deviation: DC to 2 MHz.

Modulation Frequency Response –
10 Hz (DC) to 100 kHz: <0.5 dB.
10 Hz (DS) to 2 MHz: <3 dB.

Incidental AM (AF = 1 kHz, f > 5 MHz, deviation = 40 kHz) – <0.1%.

Carrier Frequency Offset with FM –
<0.01% of max. deviation + 1% of deviation.

EXT1, EXT2 Modulation Inputs –
Input voltage for selected deviation: 1 V_{peak}.
High/low indication: For inaccuracy >3%.
Input Impedance: >100 kΩ.

PHASE MODULATION (WITH OPTION 05)
Operating Modes –
Maximum Deviation:
Without I/Q Modulation:
0.3 to 450 MHz: 20 rad.
>450 to 750 MHz: 5 rad.
>750 to 1500 MHz: 10 rad.
>1500 to 3300 MHz: 20 rad.
With I/Q Modulation:
0.3 to 750 MHz: 20 rad.
>750 to 1200 MHz: 10 rad.
>1200 to 3300 MHz: 20 rad.

Resolution – <1% minimum (0.001 rad).

Setting Error (AF = 1 kHz) – <1%.

Distortion (AF = 1 kHz, half max. deviation) – <1%

Modulation Frequency Range – DC to 100 kHz.

Modulation Frequency Response (10 Hz (DC) to 100 kHz) – <0.5 dB.

EXT1, EXT2 Modulation Inputs –
Input voltage for selected deviation: 1 V_{peak}.
High/low indication: For inaccuracy >3%.
Input Impedance: >100 kΩ.

SWEEP RELATED
Sweep Type – RF Sweep, AF sweep digital, in discrete steps.

Operating Modes – Automatic, single-shot, manual or externally triggered, linear, logarithmic.

RF Sweep, AF Sweep –
Sweep Range:
Freely selectable.
Step Width:
Lin: Freely selectable.
Log: 0.01 to 100%.

Level Sweep –
Operating Modes: Automatic, single-shot, manual or externally triggered, logarithmic.
Sweep Range: 0.1 to 20 dB.
Step width: 0.1 to 20 dB.

Step Time – 10 ms to 5 s.

Resolution – 0.1 ms.

Markers – 3, freely selectable.

MARKER Output Signal – TTL/HC logic signal, selectable polarity.

X Output – 0 to 10 V.

BLANK Output Signal – TTL/HC logic signal, selectable polarity.

LIST MODE
Values Stored – Frequency and level values.

Permissible Level Variation – 20 dB.

Operating Modes – Automatic, single-shot, manual, externally triggered.

Maximum Number of Channels – 2000.

Step Time – 1 ms to 1 s.

Step Resolution – 0.1 ms.

FADING SIMULATION (WITH OPT. 14 OR 15)
Frequency Range – Same as SMIQ.

Output Power Range – Same as SMIQ, maximum level reduced by 18 dB.

RF Bandwidth (–3 dB) – >14 MHz.

Level Frequency Response (carrier offset <5 MHz) – <±0.3 dB.

Image Rejection – >40 dB.

Operating Modes – Internal (with Option B10), external (using the external baseband I and Q inputs).

Number of Paths –
Option 14: 6.
Options 14 and 15: 12.

Number of RF Channels –
Option 14: 1.
Options 14 and 15: 2 (second SMIQ required).

Path Loss –
Range: 0 to 50 dB.
Resolution: 0.1 dB.

Path Delay –
Range: 0 to 1600 µs.
Resolution: 50 ns.
Error: <5 ns.

Doppler Shift –
Frequency Range: 0.1 to 1600 Hz.
Speed Range:

$$V_{min} = \frac{0.03 * 109\ m/s^2}{f_{RF}}$$

$$V_{max} = \frac{479 * 10^9\ m/s^2}{f_{RF}}$$

Example: V_{max} = 1916 km/h at 900 MHz.
Resolution: 0.1 km/h, m/s, mph.
Error: <0.13%.

Fading Statistics – Rayleigh, Ricean, Log Normal, Suzuki.

Signal Generators
New SMIQ

Rayleigh Fading –
Pseudo Noise Interval: >372 h.
Deviation from Theoretical CDF*4:
Level range –20 to +10 dB: <1 dB (<0.3 dB typical).
Level range –30 to –20 dB: <2 dB (<0.3 dB typical).

Ricean Fading –
Power Ratio*5:
Range: –30 to +30 dB.
Resolution: 0.1 dB.
Frequency Ratio:
Range: –1 to +1.
Resolution: 0.05.

Log Normal Fading, Suzuki Fading –
Standard Deviation:
Range: 0 to 12 dB.
Resolution: 1 dB.
Local Constant:
l_{min} to 200 m, with

$$l_{min} = \frac{12 * 10^9 \text{ m/s}^2}{f_{RF}}$$

Correlation –
Paths Correlated: 1 to 6 with 7 to 12.
Magnitude:
Range: 0 to 100%.
Resolution: 5%.
Phase:
Range: 0 to 360°.
Resolution: 1°.

Operating Temperature Range –
0 to +45° C.

SMIQ-B10, Digital Modulation Universal Coder – Modulation formats include – FSK, 4FSK, GFSK, GMSK, BSK, 8PSK, QPSK, OQPSK, π/4 DQPSK, 64, 256QAM. Maximum symbol rate, 7.5 MS/s. Filters of Gaussian, cosine and root cosine may be applied to the baseband data. PRBS data sequences can be automatically created.

SMIQ-B11, Data generator and digital standards – Includes 4 Mbit data memory and the ability to automatically generate data frames and modulation for the PHS, GSM and NADC communication standards. Data frames my be freely edited using a graphical interface.

SMIQ-B42 CGMA IS-95 data generation – Provides CDMA signals for the IS-95 standard. Base station (QPSK) and mobile (O-QPSK) modulation formats are provided. Two base station modes are included, providing pilot, sync, paging and traffic channels. Walsh code power can be individually specified on pilot, sync and paging channels. Adjacent channel power of <–70 dBc, measured at 885 kHz offset in a 30 kHz bandwidth.

INSTRUMENT SETTINGS MEMORY
Storable Settings – 50.

Memory Sequence Modes – Automatic, single-shot, manually triggered, externally triggered.

Step –
Time: 50 ms to 60 s.
Resolution: 1 ms.

REMOTE CONTROL
Standard – IEEE 488/IEC 625.

Instruction Set – SCPI 1993.0.

Connector – 24-contact Amphenol.

Bus Addresses – 0 to 30.

Interface Functions – SH1, AH1, L4, SR1, RL1, PP1, DC1, DT1, C0.

ENVIRONMENTAL
Temperature –
Operating: 0 to +50° C (contrast of LCS display degrades at high temperatures).
Storage: –40° C to +70° C.

Humidity – DIN IEC 68-2-30, +40° C.

Mechanical Stress –
Shock: To MIL-STD 810 D, 40 g shock spectrum.
Vibration:
Sinewave: To DIN IEC 68-2-6, 5 to 55 Hz.
Noise: 10 m/s 2 RMS, 10 to 300 Hz.

Electromagnetic Compatibility –
Standards Met: EN50081-1, EN 50082-1.
RF Leakage (f < 1 GHz, induced in a 2-turn loop 25 mm in diameter at a distance of 25 mm from any surface of the enclosure): <0.1 mV.
Radiated Susceptibility: 10 V/m.

Safety – Class I to VDE 0411/IEC66E and IEC1010-1.

POWER
Line Voltage – 90 to 132 V AC and 180 to 265 V AC, autosetting.

Line Frequency – 47 to 440 Hz.

Power Consumption – 300 VA maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	460	18.1
Weight	**kg**	**lbs.**
Net	25	55.1

**1 If not otherwise mentioned, data values are valid for RF ≥ 5 MHz and ATTENUATOR MODE NORMAL.*

**2 Additional level error in the ALC OFF mode = <0.3 dB.*

**3 Applies after 1 hour warm up and recalibration for 4 hours operation and temperature variations of less than 5 degrees.*

**4 CDF = Cumulative Distribution Function; level related to average output power.*

**5 Ratio of discrete component to the distributed component.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SIMQ02
Vector Signal Generator (300 kHz to 2.2 GHz).
Includes: Power Cord, Operating Manual.

SIMQ03
Vector Signal Generator (300 kHz to 3.3 GHz).
Includes: Power Cord, Operating Manual.

SMIQ OPTIONS
Opt. 01/SM-B1 – OCXO Reference Oscillator.
Opt. 05/SM-B5 – FM/φM Modulator.
Opt. 10/SMIQ-B10 – Universal Modulation Coder.
Opt. 11/SMIQ-B11 – 4 Mbit Data Generator with Digital Standards PHS, NADC and GSM.
Opt. 12/SMIQ-B12 – 8 Mbit Memory Extension.
Opt. 14/SMIQ-B14 – 6-Path Fading Simulator.
Opt. 15/SMIQ-B15 – Additional Fading Simulator for 2-channel or 12-path Fading.
Opt. 42/SMIQ-B42 – Digital Standard CDMA IS-95.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Rackmount for 19" Rack – Order ZZA-94.
Service Kit – Order SM-Z2.

Signal Generators
SME

Features

SME

- Frequency Range
  5 kHz to 6 GHz SME06
  5 kHz to 3 GHz SME03
  5 kHz to 2.2 GHz SME03E
  5 kHz to 1.5 GHz SME02
- All Common Digital Modulation Modes Provided in One Unit: GMSK, π/4-DQPSK, GFSK, FSK, 4FSK, FFSK, ...
- All Modulation Modes Usable over the Entire Frequency Range
- No External Modulation or Data Sources Required
- Internal Control of Frequency and Level Hopping Synchronous with the Data Signal
- Freely Programmable Data Sequences and Trigger Conditions
- Frequency Setting Time <0.5 ms for Frequency-agile Systems (Not Available in SME03E)
- Broadband, Linear AM DC for Generation of Level Bursts with Predefined Shape
- Extremely High Spectral Purity for Out-of-channel Measurements
- Very High Level Accuracy; Resetting Error of Attenuator 0.01 dB
- RF, AF, and Level Sweep
- Programmable Measurement Sequence for up to 50 Complete Instrument Settings
- Ultra-low RF Leakage for Measurements on Highly Sensitive Paging Receivers
- Easy-to-operate Menu Concept

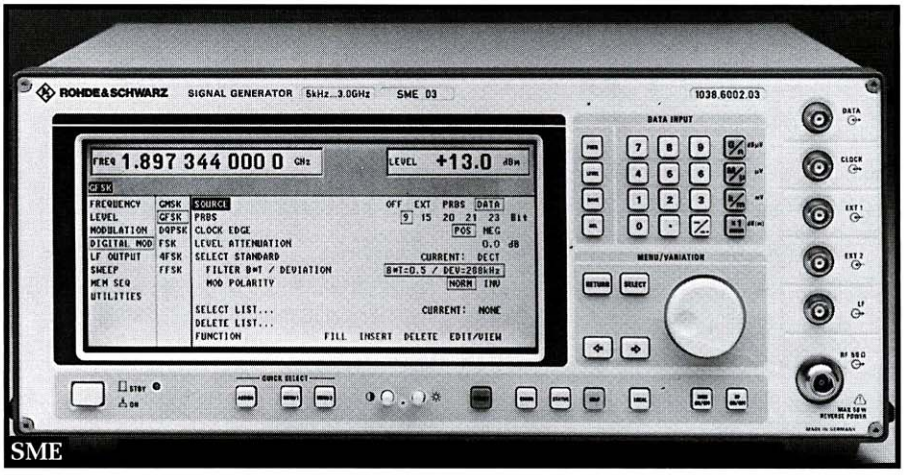
Applications

- Digital Radio Receivers
- Digital Radio Networks
- Analog Modulations

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987 with SCPI conformance.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



SME

SME Signal Generator

The SME Signal Generator supplies the complex signals required for the development and testing of digital mobile radio receivers. It's capable of generating all signals used in the main digital radio networks in line with relevant standards regarding the type of modulation, data format, TDMA structure, and frequency hop patterns. The SME is also useful in the analog signal world of conventional signal generators.

The SME covers a frequency range from 5 kHz to 6 GHz. They can be tailored to your requirements by means of a wide variety of options with emphasis either on digital modulation, analog applications, or expansion into a universal signal generator.

DIGITAL MODULATION
With the DM Coder (standard on SME03E, Option 11 all other models) the SME provides a variety of network-specific digital modulation modes:

Modulation	Network
GMSK	GSM, DCS 1800/DCS 1900 (PCN), CDPD, DSRR, MC9, MOBILTEX
π/4-DQPSK	NADC, PDC, TFTS, TETRA, APCO25
GFSK	DECT, CT2, CT3
4FSK	ERMES, APCO25 FLEX, MODACOM
FSK, FFSK	POCSAG, FLEX, Cityraf

The SME has been designed to allow for the integration of future types of modulation and networks.

Frequency and phase changes are produced by DDS (direct digital synthesis). The frequency and phase response are therefore synthesizer-accurate. There is no drift at the carrier frequency. The DM coder is provided standard in the SME03E.

The modulation spectrum stands out for its high spectral purity. Sidebands are well below permissible levels at the frequency spacing relevant for adjacent-channel measurements. Filters other than the standard ones may be used for varying the modulation spectrum (for GMS network: filters with BxT = 0.2, 0.3, 0.5). With GFSK modulation for DECT, non-standard deviations may be set to allow in-depth receiver tests.

The data signals for modulation are applied externally or supplied by the internal data generator. Bit rates are selectable with FSK; they are network-specific for other types of modulation.

Signal Generators
SME

Data Generator: The data generator supplies freely programmable data signals and Pseudo Random Bit Sequence (PRBS) signals in line with CCITT. For PRBS signals, five sequence lengths between $2^9 - 1$ and $2^{23} - 1$ are selectable. Up to ten different data signals can be stored.

Level and Frequency Hopping Synchronous with Data Signal: In addition to the data signal, the data generator supplies a burst and level switch signal. The burst and level switch signals are programmed bit-parallel with the data signal via list entries. The burst signal serves for controlling fast level changes (>80 dB) or frequency changes (<0.5 ms).

The internal level switch signal can be replaced by an external logic signal. The signal switches the level in selectable steps with a rise/fall time <10 µs and enables level variations of up to 20 dB (overrange up to 40 dB).

ANALOG MODULATION

Amplitude Modulation: The modulation frequency range is DC to 100 kHz. Particularly noteworthy is the extremely low incidental phase modulation with AM, which plays an important role in AM sensitivity tests on FM receivers.

Frequency Modulation (with Option 05): The modulation frequency range is DC to 2 MHz. The maximum selectable deviation for modulation frequencies above 500 kHz linearly decreases to 25% at 2 MHz. In the FM DC mode, there's virtually no drift. This allows the digital signaling of receivers by means of analog frequency modulation.

Phase Modulation (with Option 05): Phase modulation ranges from DC to 100 kHz. This wide span allows, for instance, tests on phase-sensitive circuits or the generation of PSK modulation with freely selectable phase deviation.

Pulse Modulation (SME02 Option 03, SME03 Option 08, SME06 Option B9): The pulse modulation capability featuring an on/off ratio better than 80 dB and a rise/fall time shorter than 10 ns makes the SME an ideal choice for radar applications. The optional pulse generator allows pulsed signals to be produced without an external source.

ANALOG MODULATION SOURCES

Three optional modulation sources are available in addition to the standard fixed-frequency LF generator source:

LF Generator (Option 02): The LF generator is a synthesizer up to 500 kHz. In addition to sinewave, squarewave, and triangular signals, it also supplies a noise signal. If two LF generators are installed in the unit, multitone signals can be generated.

Multifunction Generator (Option 06): This generator operates in a range up to 1 MHz. It produces the same signals as the optional LF generator and, in addition, stereo multiplex and VOR/ILS modulation signals.

Pulse Generator (Option 04): The pulse generator generates single and double pulses required for radar receiver testing. It can only be used in conjunction with the pulse modulator module, into which it's integrated.

SIMULTANEOUS MODULATION

Simultaneous modulation is required for simulating the complex signals used in modern communications and radar systems. The SME is capable of simultaneous DM, AM, FM (φM) and pulse modulation.

With AM and FM, multitone modulation can be affected either by means of the internal and an external modulation signal or, if two LF generators are provided, by means of two internal signals.

Convenient Sweeping in List Mode: Operation is extremely easy thanks to a well thought-out operating concept featuring a large LCD display and menu guidance. All parameters and conditions selectable for a specific function are logically arranged in a single display. Looking up functions in a manual is a thing of the past.

In the list mode, frequency and level settings are made by means of values stored in lists which may contain up to 4,096 pairs of frequency and level. This mode allows the frequency response of cable connections, amplifiers, TEM cells, etc., to be compensated in the signal generator, a particularly useful feature in EMC measurements.

The list mode may be executed either automatically with presettable dwell time, in single-step operation, or by means of external triggering (for frequency hopping applications). List mode is not provided in the SME03E.

Memory Sequence for Automatic Sequence Control: Up to 50 instrument settings can be stored in a non-volatile memory. After programming the sequence of measurements and the step time in a list, the sequence can be started.

External Triggering: In addition to automatic control, the list mode, memory sequence, RF, AF, and level sweep functions may also be triggered by an external signal. This facility enables synchronous operation with other units.

Compensation of External Frequency Response: The frequency response of external cables can be compensated by entering level correction values for up to 100 frequency points. The correction values for the frequencies between these points are determined by means of interpolation. The frequency response correction will be active in any operating mode as well as during sweeps.

CALIBRATION

Calibration of the unit is required every three years. Calibration values are loaded via the RS-232-C or the IEC/IEEE-bus interface to ensure frequency and level accuracy to specifications. The unit doesn't need to be opened, nor are there any mechanical adjustments to be made.

SELF-DIAGNOSTICS

For maintenance and calibration, precise data on the instrument status are needed. Using the built-in test equipment, the SME Series provides data without any extra equipment required. The signal generator status is continuously monitored. The SME signals malfunctions and deviations from nominal values by means of a message on the display screen.

TDMA FRAME EDITOR SOFTWARE

The optional SME-K2 software allows you to easily program complex frame structures. Preprogrammed data sequences for most important telecommunications systems are provided so that you can quickly make measurements on the device-under-test. Communication standards GSM, NADC, DECT, PDC and PCS1900 are supported with SME-KZ.

Signal Generators
SMHU58

Features

SMHU58

- I/Q Modulator for Any Phase and Amplitude Modulation (PSK, QAM, ASK, etc.), Modulation Bandwidth DC to 200 MHz
- Second, Coherent Carrier for Simple I/Q Demodulation
- Broadband Amplitude Modulation for TV Applications
- Broadband Frequency Modulation for Satellite Communications, Radar, and Video Applications
- Optional Coders for Generating Modulating Signals for Digital Radio Networks to Relevant Standards (GSM, NADC, DECT, CDMA)
- Frequency Hopping – 4800 Stored Frequency and Level Settings
- Parallel Bus Interface for External Addressing of Memories
- Setting Time <1 ms for Frequency-agile Systems
- High Spectral Purity for Out-of-channel Measurements and LO Applications
- High Output Power (+19 dBm)
- High Carrier Frequency Accuracy and Drift-free FM DC for FSK and VCO Modes
- Fast AM DC for Generating Level Bursts
- RF, AF, Level, and Memory Sweeps for Automatic Test Runs

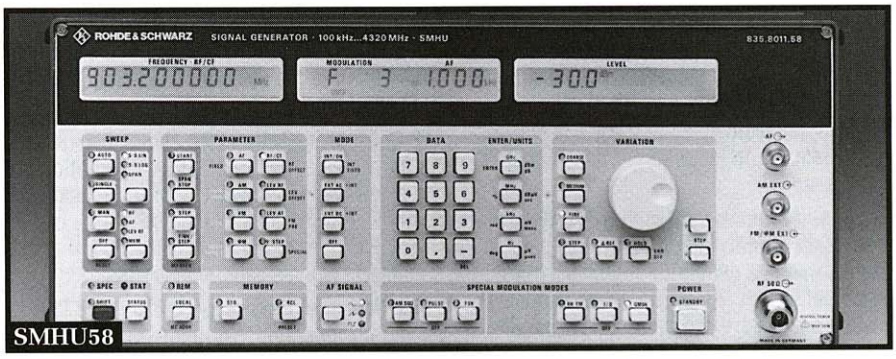
Applications

- Mobile Radio
- Radar Systems
- Directional Radio
- Satellite Communications Simulation
- Cellular and PCS

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



SMHU58 Signal Generator

The SMHU58 Signal Generator can generate complex test signals for modern communications and radar systems. Its high versatility is based upon the great variety of modulation capabilities in conjunction with high spectral purity and frequency hopping.

The I/Q and the broadband AM/FM modulators make all digital and analog modulation modes for directional radio and satellite communications possible. Modern radio networks use digital modulation methods, for which the SMHU58 is ideally suited due to the high accuracy of its I/Q modulator.

For modulation using serial data signals, coders can be integrated for the necessary signal processing and filtering to relevant standards. The optional coders produce filtered analog signals from a serial data stream for driving the I/Q modulator. The accuracy of the resulting phase modulation meets all requirements placed on a reference signal for NADC, DECT, PDC, and GSM testing. The CDMA coder uses Qualcomm chips to generate standard channels.

Broadband FM can be used for fast FSK, analog sweeping, video modulation, and for generating chirp signals.

MODULATION
Internal and external, or both internal modulation sources, can be combined for two-tone modulation.

Frequency Modulation: The maximum deviation depends upon the carrier frequency. Starting from a maximum deviation of 3.2 MHz in the frequency range 2.16 to 4.320 GHz, the maximum deviation decreases with the carrier frequency.

By selecting a special function, deviations of up to 800 kHz can be set even below 125 MHz. The FM modulation frequency range covers DC to 1 MHz. In FM DC mode, a high carrier-frequency accuracy is ensured. The frequency offset occurring with FM DC selected is extremely small.

Amplitude Modulation: The whole of the modulation frequency range can be used down to carrier frequencies of less than 100 kHz. The minimal phase shift at 30 Hz (AM DC) and a flat frequency response provide the precision amplitude modulation required for testing VOR/ILS navigation receivers.

Pulse Modulation: Rise/fall times of 20 ns (<10 ns typical for frequencies >200 MHz) and an on/off ratio of 80 dB open up a wide range of possibilities for testing telemetry, radio link, radar, and satellite communications systems.

I/Q Modulator: The I/Q modulator is adjusted for minimum amplitude and phase error in an automatic calibration routine. The settings can also be varied to simulate a non-ideal behavior of the modulator. With the aid of selectable defined modulation distortion, effects on bit error rates can be determined and demodulator maladjustments corrected.

Coder Options: The serial data signal may be derived from an external source or from a PRBS generator in the coder. By digital processing in the coder, the data signal is shaped as required for the prescribed filter function and split into I and Q signals. In addition to the standard filter functions provided, special filter functions for various bandwidths are programmed in the coder. They are used for specific variations of the modulation spectrum to enable investigations of non-standard signals. The extremely high modulation accuracy meets all the requirements placed on a reference signal for use in receiver testing. Separate coders are required for CDMA, GSM, DECT and NADC/PDC networks, since type of modulation, clock

Signal Generators
SMHU58

frequency, and baseband filtering are different in each network. The SMHU58 can accommodate one coder module.

Broadband AM: The I/Q modulator is also used for broadband amplitude modulation within a modulation bandwidth of 50 MHz. There are no limiting effects up to a level of +7 dBm. Modulation range, linearity, and bandwidth make the SMHU58 an ideal instrument for TV applications.

Broadband FM: This mode allows modulation frequencies up to 20 MHz. The frequency deviation can be adjusted in fine steps in the range from 1 kHz to 50 MHz. Through the simultaneous use of pulse modulation and Broadband FM, the SMHU58 can generate radar chirps with a frequency variation of 100 MHz in less than 100 ns. Further applications are in the field of video measurements and in satellite reception.

Frequency Modulation: FM applications range from high-quality stereo modulation to fast FSK. The maximum deviation usually decreases with the carrier frequency. This is different when FM is simultaneously used with I/Q or Broadband AM. The maximum deviation then has a constant value of 3.2 MHz in the range between 5 MHz and 1.95 GHz.

High carrier frequency accuracy is ensured in FM DC mode. When FM DC is selected, the frequency offset remains smaller than $10^{-7} \times f_c$ (f_c = carrier frequency) and smaller than 400 Hz for I/Q modulation and Broadband AM. There is practically no drift. This is particularly useful for receivers with digital signaling.

CHARACTERISTICS

Instrument	SMIQ02/03	SME Series	SMHU58
FREQUENCY			
Range	300 kHz to 2.2 GHz (SMIQ02) 300 kHz to 3.3 GHz (SMIQ03)	5 kHz to 1500 MHz (SME02) 5 kHz to 2200 MHz (SME03E) 5 kHz to 3000 MHz (SME03) 5 kHz to 6000 MHz (SME06)	Vector Modulated: 5 to 2000 MHz CW or Analog Modulation: 100 kHz to 4320 MHz
Resolution	0.1 Hz	0.1 Hz	0.1 Hz
Setting Time	<15 ms/<500 µs	<10 ms/<500 µs	<10 ms/<500 ms
Stability			
Standard	1ppm/y	1ppm/y	<0.001 ppm/day
Option	<0.001 ppm/day	<0.001 ppm/day	
SSB PHASE NOISE AT 1 GHZ			
(CW, 20 kHz offset)	<–126 dBc/Hz	<–126 dBc/Hz	<–134 dBc/Hz
(Vector Mod, 20 kHz offset)	<–123 dBc/Hz	NA	<–98 dBc/Hz
HARMONICS			
	<–30 dBc/≤10 dBm	<–30 dBc/≤10 dBm	≤–30 dBc
SUBHARMONICS			
	none	none/f ≤1.5 GHz <–40 dBc/f ≤3 GHz <–34 dBc/f >3 GHz	none/f ≤2.16 GHz <–60 dBc/f >2.16 GHz
NONHARMONIC SPURIOUS			
(CW, Analog Modulation)	<–74 dBc (f<450 MHz/>10 kHz) <–80 dBc (0.45 to 1.5 GHz/>10 kHz offset) <–74 dBc (1.5 to 3 GHz/>10 kHz offset)	<–80 dBc (f<1.5 GHz/>5 kHz) <–74 dBc (f≤3 GHz/>5 kHz) <–68 dBc (f>3 GHz/5 kHz)	<–100 dBc (f<1 GHz) <–94 dBc (up to 2 GHz)
(Digital Modulation)	<–70 dBc/10 kHz to 300 MHz offset <–60 dBc/>300 MHz offset	<–66 dBc (f<1.5 GHz/>5 kHz) <–60 dBc (f≤3 GHz/5 kHz) <–54 dBc (f>3 GHz/5 kHz)	<–74 dBc for GSM/PCN range
LEVEL			
Range	–140 to +13 (16) dBm	–144 to +13 (16) dBm	–140 to +13 (19) dBm
Resolution	0.1 (0.01) dB	0.1 dB (0.01) dB	0.1 dB
Accuracy			
f≤1.5 GHz/≥ –127 dBm	<±1.0 dB	<±1.0 dB	<±1.5 dB
f≤2 GHz/≥ –127 dBm	<±1.0 dB	<±1.5 dB	<±1.5 dB
f≤4 GHz/≥ –127 dBm		<±2.0 dB	<±2.5 dB
Settling Time	<25 ms	<25 ms	<25 ms
VSWR			
	<2	<1.5 (≤3 GHz, ≤0 dBm)	<1.8 (≤3 GHz)
I/Q MODULATION			
Bandwidth	DC to 30 MHz/3 dB		DC to 200 MHz/3 dB
Static EVM(rms)			typ. 0.5%/peak
Magnitude Error	<0.5%, typ. <1%, peak	not available	<2.3% dB/peak
Phase Error			<1.2 deg/peak
Origin Offset	<–50 dBc		<–50 dBc

Signal Sources
SMHU58

Instrument	SMIQ02/03	SME Series	SMHU58
DIGITAL MODULATION	**OPTION SMIQ-B10**	**OPTION SME-B11/12 OPT. B11 STANDARD ON SME03E**	**STANDARD SPECIFIC CODER OPTIONS**
Modulation Types	FSK, 4FSK, GFSK, GMSK, BSK, 8PSK, QPSK, OQPSK, π/4 DQPSK, QAM	FSK, 4FSK, FFSK, GFSK, GMSK, QPSK	only digital Standards
Digital Standards	Optional CDMA (IS-95), NADC, GSM, PHS	PDC, NADC, GSM, DECT, FSK, FFSK, ERMES, PCN, TFTS, TETRA, CT2, CT3, CDPD, Mobitex, (with SME-B11)	Coder Options for: GSM, NADC/PDC, DECT, PHS, TETRA, CDMA
DATA SOURCE	**INT/EXT**	**INT/EXT**	**INT/EXT**
Internal Data	PN9/15/16/20/21/23 Data Generator Option SMIQ-B11, B12 with up to 20 Mbit Memory	internal PRBS and DATA Generator up to 8 Mbit (with SME-B11 + SME-B12)	internal PRBS or EXT. data sequence (with Digital Coders)
Int. Data Structure	Frame/Slot/user defined	Up to 8 MB int. Data Memory Data/Burst/Lev Att	none
BURST SIGNAL			
Control	Int and Ext.	with Option SME-B11 Internal	ADS + IQSIM
On/Off Ratio	>80 dB, 30 dB linear	typ. 50 dB (SME-B11) >80 dB	typ. 50 dB (I/Q control)
Rise Fall Time	programmable up to 32 symbols, resolution ¼ symbol	(SM-B3/8/9) Fast/GSM spec.	
AM MODULATION			
Rate	DC to 50 kHz (–3 dB)	DC/Hz to 100 kHz (–3 dB)	DC/10 Hz to 50 kHz (–3 dB)
Range	0 to 100%	0 to 100%	0 to 100%
Resolution	0.1%	0.1%	0.1%
Accuracy (1 kHz)	<4% of setting +1%	<4% of setting ±1%	<4% o.s. ±1% (≤2.16 GHz)
THD (1 kHz, 30%)	<1%	<1%	
THD (1 kHz, x%)	<2% @ 80%	<2% @ 80%	<2% @ 60%
WIDEBAND AM			
	DC to 30 MHz (–3 dB)	not specified	DC to 50 MHz (–3 dB)
FM MODULATION	**OPTION SM-B5**	**OPTION SM-B5**	**STANDARD**
Modulation Paths	2	2	1
Deviation	2 MHz	1/2/4 MHz	3.2 MHz
Freq. Response	DC to 2 MHz (25% max dev)	DC/10 Hz to 2 MHz (–3 dB)	DC/10 Hz to 1 MHz (–3 dB)
Resolution	<1%, min. 10 Hz	<1% of deviation/min. 10 Hz	<1% of deviation/min.
Accuracy (1 kHz	<3% of setting + 20 Hz	<3% of setting + 20 Hz	<3% of setting + 20 Hz
THD (1 kHz)	<0.5% (0.5 max dev.)	<0.5%, typ. 0.05% (0.5 max dev.)	<0.2%, 0.5 max dev.
PHASE MODULATION	**OPTION SM-B5**	**OPTION SM-B5**	**STANDARD**
Modulation Paths	2	2	1
Deviation	20 rad	10/20/40 rad	320 rad
Freq. Response	DC to 100 kHz	DC/10 Hz to 100 kHz (–0.5 dB)	10 Hz to 10 kHz
Resolution	<1%, min. 0.001 rad	<1%, min. 0.001 rad	<1%, min. 0.001 rad
Accuracy (1 kHz)	<3% of setting +0.01 rad	<3% of setting +0.01 rad	<5% of setting +0.01 rad
THD (1 kHz)	<1% (0.5 max dev.)	<1% (0.5 max dev)	<0.5%, 0.5 max dev
PULSE MODULATION	**STANDARD**	**OPTION SM-B3/8/9**	**STANDARD**
ON/OFF Ratio	>80 dB	>80 dB	>80 dB
Max. Output Level	13 dBm	10/9/8 dBm	
Level Accuracy	like CW	like CW	like CW
Rise/Fall Times	<10 ns	<10 ns	<20 ns
Min. Pulse Width	typ. <100 ns	<20 ns	<40 ns
PRF	10 MHz	10 MHz	
Int. Pulse Generator		SM-B3/8/9	N/A

Signal Sources
SMHU58

SWEEP						
Functions	Digital, in discrete steps, linear or log		Digital, in discrete steps, linear or log		Digital, in discrete steps, linear or log	
Modes	Automatic, manual, single-shot, and external triggered		Automatic, manual, single-shot, and external triggered		Automatic, manual, single-shot, and external triggered	
Start/Stop	YES		YES		YES	
Center Frequency/Delta Frequency	YES with Opt. 05 and 06		YES with Opt. 05 and 06		YES	
Markers	3		3		User-selectable	
OTHER FEATURES						
IEEE-488 Interface	YES		YES		YES	
Self-diagnostics	YES		YES		YES	
Overload Protection	50 W Max RF, 35 V Max DC		50 W Max RF, 35 V Max DC		30 W Max RF, 35 V Max DC	
POWER REQUIREMENTS						
Line Voltage	90 to 132 V, 180 to 265 V		90 to 132 V, 180 to 265 V		100/120/220/240 V	
Line Frequency	47 to 440 Hz		47 to 440 Hz		47 to 63 Hz	
ENVIRONMENTAL						
Operating Temperature	0 to 50°C		0 to 50°C		0 to 50°C	
Mechanical Stress	MIL-STD 810 D		MIL-STD 810 D		DIN 40046 (8)	
Electromagnetic Compatibility	MIL-STD 461 B, RE02, CE03, CS01, CS02		MIL-STD 461 B, RE02, CE03, CS01, CS02		MIL-STD 461 B, CE03, RE02	
PHYSICAL						
Dimensions	**mm**	**in.**	**mm**	**in.**	**mm**	**in.**
Height	192	7.89	192	7.89	192	7.89
Width	435	17.8	435	17.8	435	17.8
Depth	460	18.9	460	18.9	460	18.9
Weight	**kg**	**lbs.**	**kg**	**lbs.**	**kg**	**lbs.**
Net	25	55	25	55	26	57.2

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SME06 – Signal Generator (5 kHz to 6 GHz).
SME03 – Signal Generator (5 kHz to 3 GHz).
SME03E – Signal Generator (5 kHz to 2.2 GHz).
SME02 – Signal Generator (5 kHz to 1.5 GHz).
Opt. 01/SM–B1 – Reference Oscillator OCXO.
Opt. 02/SM–B2 – LF Generator.
Opt. 03/SM–B3 (SME02) – Pulse Modulator.
Opt. 04/SM–B4 (Opt. 03, Opt. 08 or Opt. 09 required) – Pulse Generator.
Opt. 05/SM–B5 – FM/φM Modulator.
Opt. 06/SM–B6 – Multifunction Generator.
Opt. 08/SM–B8 (SME03/SME03E) – Pulse Modulator.
Opt. 09/SM-B9 (SME06) – Pulse Modulator.
Opt. 11/SME–B11 – (Standard SME03E) DM Coder.
Opt. 12/SME–B12 – DM Memory Expansion.
Opt. 19/SME–B19 – Rear Connectors for RF and AF.
Opt. 41/SM-B41 – Flex Protocol.
Opt. 42/SM-B42 – POCSAG Protocol.

SMHU58 – 4.32 GHz Signal Generator.
Opt. 01/SMHU–B2 – GMSK Coder for GSM, PCS Networks.
Opt. 02/SMHU–B3 – GFSK Coder for DECT Networks.
Opt. 03/SMHU–B4 – π/4 DQPSK. Coder for NADC, PDC Networks.
Opt. 04/SMHU–B5 – π/4 DQPSK Coder for PHS Networks.
Opt. 06/SMHU–B6 – CDMA Coder.
Opt. 10/SMGU–Z9 – Rear-panel Connectors.

MEASUREMENT SERVICE OPTIONS SME02/03/03E/SME06/SMHU58
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

SME-K2
TDMA Frame Editor Software for SME Series
RECOMMENDED ACCESSORIES – Also see page 438.
Rear-panel Connectors for RF and AF – Order SMGU-Z9.
19 in. Rack Adapter – Order ZZA-94.
Service Kit – Order SMGU-Z2.
SME-K2 – TDMA Frame Setup Software for SME Series.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Generators
IQSIM

Features

IQSIM

- Digital Modulation
- Superpositioning/Simulation of Interference Sources
- Power Ramping
- Data Transfer to Arbitrary Waveform Generator

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

IQSIM Software

IQSIM software for simulating I/Q signals allows the mathematical simulation of all digital modulations presently known, including CDMA. The simulated signals to be modulated are transferred to an arbitrary waveform generator whose output signals feed a signal generator with a built-in I/Q modulator.

Characteristics

System Features –
User Interface: Automatic adaptation to the graphic mode used, menus following SAA standard, context-sensitive help system, interactive dialog boxes, access to DOS.
Types of Modulation – 2PSK, 4PSK, 0-4PSK, 8PSK. 16QAM, 64QAM, 256QAM.
CFSK (m = 0.1 to 10). GFTM (b = 0 to 1).
4FSK (m = 0.1 to 20).

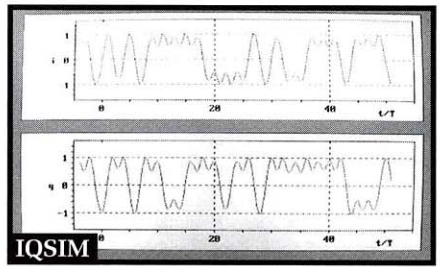
Filter Functions –
Digital Filters: No filter, Sinx/x filter, $\sqrt{\text{cosine}}$ filter, Roll-off factor r = 0.1 to 1, Cosine filter, roll-off factor r = 0 to 1, Gauss filter, bandwidth time product B x T = 0.1 to 1, User-specific FIR filters.
Window Function: Rectangular, Hanning window, Kaiser window. Parameter β = 0.1 to 20.
Pulse Length: 1 to 16-Bits/symbol.
Oversampling Factors: 4 to 32 in steps of 2.
Bit rate:

$$0 \text{ to } \frac{25 \text{ Mbits/s}}{(\text{oversampling factor})} \times \text{bit/symbol}$$

Coding – None, Gray coding, GSM coding (Groupe Spéciale Mobile), NADC-PDC coding (North American Digital Cellular, Pacific Digital Cellular), TFTS coding (Terrestrial Flight Telephone System).

Data Sources –
Pseudo-random Bit Sequences, Data Length: 127/511/2047/32767-Bits.
User-defined Data: Editor function, chaining, filling, saving.
Maximum Length: (16384/oversampling factor) x bit/symbol.

Simulation of Interference Sources –
Linear distortion effects – Carrier Leakage in I/Q: ±10%. IQ imbalance in I/Q: ±20%. Quadrature Offset: ±10%.



Nonlinear Distortion Effects – AM/AM Conversion (k2), (k3): ±10%. AM/PM Conversion (k1), (k2): ±10%.

Noise – Energy per Bit Related to Noise (energy Eb/noise): –36 to –3 dB. Normalized Noise Bandwidth: B x T_s = 0/0.5/1/2/4.

Co-channel interference – Simulation of interference source.

Amplitude shape/power ramping – Amplitude Control of the RF Signal: 0 to –60 dB.

Graphic Simulation –
Graphics: I(t), Q(t), r(t), φ(t), r(t), f(t), vector diagram, eye diagram, (r = amplitude function, φ = angle function, f = frequency function).
Scaling: User-selectable.

Transfer Interface – Setting Functions: IEC/IEEE-bus address of generator, choice of generator AMS or ADS, I/Q format or FM/AM format quantization maximum 12-Bit, interpolation between r = first and last bit.

REQUIRED HARDWARE
Controller –
Type: PSA controller family or AT-compatible.
Operating system: MS-DOS 3.00 and higher.
Main Memory: 350 KB RAM minimum.
Monitor and Graphics Adapter: Hercules graphic card and monochrome monitor, EGA/VGA with monochrome or color monitor.
IEC-bus Card (IEEE 488.1): Rohde & Schwarz IEC/IEEE-bus driver (PS-K2) or National Instruments GPIB-PC software.
Mouse: Rohde & Schwarz PS-B11, serial Microsoft mouse, or compatibles.

Generator –
SMHU58 Signal Generator: Signal generator with I/Q modulator 1 kHz to 4.32 GHz.
ADS Generator: 2-CH programmable ARB generator. AWG 2003: AWG 2020/21 with second channel option.

Extra – Clock Generator ADS-B1

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

IQSIM-K I/Q Simulation Software.
Includes: Manual.

Signal Generators
SMP

Features

SMP

- Frequency Range 2 to 40 GHz (SMP04), 2 to 26.5 GHz (SMP03), 10 MHz to 20 GHz (SMP02, SMP22 Opt. 11), 2 to 20 GHz (SMP02, SMP22)
- Maximum Output Level +8 dBm (SMP04), +12 dBm (SMP03), +11.5 dBm (SMP02), +20 dBm (SMP22)
- AM, FM, φM, and Pulse Modulation
- Ultra-low RF Leakage
- Large LCD Display
- Menu-guided Operation with All Menu Levels Shown at a Glance
- Two Menu Memories to Speed up Operation
- Non-volatile Storage for up to 50 Complete Instrument Setups
- Remote Control Interface IEC625/IEEE 488

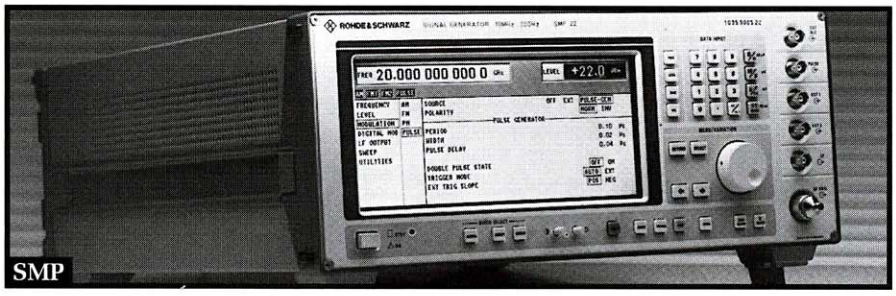
Applications

- Radar and Communications Receiver Testing
- Research and Development
- EMI Testing

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987 with SCPI conformance.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



SMP Signal Generator

The SMP Signal Generator is a high-frequency microwave signal source providing high output power with accurate level setting, high spectral purity, and excellent pulse modulation. The SMP can supply signals for radar and communications receiver tests. A wide range of extensions ensures universal use in research, production, EMC measurements, and material testing.

UNAMBIGUOUS RESULTS DUE TO HIGH SPECTRAL PURITY
The frequency range from 2 to 20 GHz is directly generated by YIG oscillators so that there are no subharmonics which may cause measurement errors. Non-harmonics of <–60 dBc and a specified SSB phase noise of >92 dBc/Hz at 10 GHz allow the user to concentrate on the device-under-test without wasting time in tracking down spurious signals of an inadequate signal source.

STABLE OUTPUT FREQUENCY
The built-in crystal reference ensures an accurate and low-drift output frequency. The SMP can also be fitted with an oven-controlled crystal oscillator (with OCXO, Option 01) to meet the most exacting requirements.

HIGH OUTPUT LEVEL ELIMINATES THE NEED FOR ADD-ON UNITS
A large number of microwave measurements requires mainly one thing: a high output level, which until now has only been possible with expensive add-on amplifiers. The SMP22 features a guaranteed level of 20 dBm (without attenuator) and thus sufficient reserves for compensating the attenuation of long cables as well as the losses of power splitters and directional couplers. The SMP22 is therefore ideal for the many applications that require a high output level.

Characteristics (Common)

FREQUENCY
Range – See chart **page xxx**.
Resolution – 0.1 Hz.
Accuracy @ 1 GHz – 1000 Hz based on reference aging rate per year.
Stability – $\pm 1 \times 10^{-6}$/year, $\pm 1 \times 10^{-9}$/day, with Opt. 01.
Setting Time – <11 ms +10 ms/GHz after IEEE bus delimiter.

OUTPUT LEVEL
Range – See chart page 232.
Resolution – 0.1 dB.
Accuracy – ±0.6 to ±1.5 dB level dependent.

MODULATION
AM Rate – DC to 100 kHz.
AM Depth – 0 to 90%.
FM Rate – DC to 1 MHz.
FM Max Deviation – SMP02, SMP22: 10 MHz. SMP03, SMP04: 20 MHz (2 MHz with Option 5).
Phase Modulation – Yes with Opt. 02 and 05.
Phase Rate – 0.4/1/3/15 kHz internal, DC to 100 kHz external.
Phase Deviation (maximum) – 10 radians.
Pulse Modulation – Yes with Opt. 14.
Pulse width: 20 ns to 1 s.
Pulse rate: 100 ns to 85 s, 0 to 10 MHz.
Pulse delay: 20 ns to 1 s.
On/Off Ratio – >80 dB.
Rise/Fall Time – <10 ns.
Simultaneous Modulation – Yes
Internal Modulation Generator – 0.4/1/3/15 kHz.
Digital Modulation – Yes, external.
FSK Modulation – Yes, external.

Continued on next page.

Signal Generators
SMP

SWEEP

Functions – Digital, in discrete steps, linear or log.

Modes – Automatic, manual, single-shot and external triggered.

Start/Stop – Yes.

Center Frequency/Delta Frequency – Yes.

Markers – 3.

OTHER FEATURES

IEEE-488 Interface – Yes.

POWER REQUIREMENTS

Line Voltage – 90 to 132 V, 180 to 265 V.

Line Frequency – 47 to 440 Hz.

ENVIRONMENTAL –

Operating Temperature – SMP02, SMP03, SMP04: 0 to 50°C. SMP22: 0 to 50°C.

Mechanical Stress – MIL-STD 810 D.

Electromagnetic Compatibility – MIL-STD 461 B, RE02, CE03, CS01, CS02.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.89
Width	435	17.8
Depth	570	23.42
Weight	**kg**	**lbs.**
Net	27	59.4

	SMP02	SMP03	SMP04	SMP22
FREQUENCY				
Range	2 to 20 GHz (10 MHz to 20 GHz with Opt. 11)	2 to 27 GHz (10 MHz to 27 GHz with Opt. 11)	2 to 40 GHz (10 MHz to 40 GHz with Opt. 11)	2 to 20 GHz (10 MHz to 20 GHz with Opt. 11)
OUTPUT LEVEL				
Range	–20 to +11.5 dBm to –130 dBm with Opt. 15	–20 to +12 dBm to –130 dBm with Opt. 15	–20 to +8 dBm to –130 dBm with Opt. 15	–20 to +20 dBm to –130 dBm with Opt. 15
SPECTRAL PURITY				
Harmonics	≤–30 dB, –50 dBc typical above 1.8 GHz	<–40 dBc, f>20 GHz	<–30 dBc, f>20 GHz	≤–25 dBc
Subharmonics	None f<20 GHz	<–40 dBc f>20 GHz	<–40 dBc f>20 GHz	None f>20 GHz
Nonharmonics at >10 kHz from carrier	<–60 dBc f<20 GHz	<–50 dBc f<2 GHz <–60 dBc f>2<20 GHz <–54 dBc f>20 GHz	<–50 dBc f<2 GHz <–60 dBc f>2<20 GHz <–54 dBc f<20 GHz	<–60 dBc f<20 GHz
Residual FM				
10 MHz to 10 GHz	<5 Hz	<5 Hz	<5 Hz	f<5 Hz
10 GHz to 20 GHz	<10 Hz	<10 Hz	<10 Hz	f<20 GHz
20 GHz to 27/40 GHz	–	–	–	–
Residual AM				
10 MHz to 2 GHz	<0.1%	<0.1%	<0.1%	<0.1%
2 GHz to 20/27/40 GHz	<0.05%	<0.05%	<0.05%	<0.05%
SSB Phase Noise	<–64 dBc f>10 MHz <10 GHz <–58 dBc f>10 MHz <20 GHz	<–64 dBc f>10 MHz <10 GHz <–58 dBc f>10 MHz <20 GHz <–52 dBc f>20 MHz <27 GHz	<–64 dBc f>10 MHz <10 GHz <–58 dBc f>10 MHz <20 GHz <–52 dBc f>20 MHz <40 GHz	<–64 dBc f>10 MHz <10 GHz <–58 dBc f>10 MHz <20 GHz

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SMP02
20 GHz Signal Generator.

SMP03
26.5 GHz Signal Generator.

SMP04
40 GHz Signal Generator.

SMP22
20 GHz Signal Generator.
Includes: Power Cable, Operating Manual, 3.5 mm Female Adapter (SMP02, SMP03, SMP22), 2.9 mm Female Adapter (SMP04).

Opt. 01/SM–B1 – OCXO Reference Oscillator.

Opt. 02/SM–B2 – LF Generator.

Opt. 05/SM–B5 – FM/φM Modulator.

Opt. 11/SMP–B11 – Frequency Extension, 0.01 to 2 GHz.

Opt. 12/SMP–B12 – Pulse Modulator, 2 to 40 GHz.

Opt. 13/SMP–B13 – Pulse Modulator, 0.01 to 2.0 GHz.

Opt. 14/SMP–B14 – Pulse Generator.

Opt. 15/SMP–B15 – RF Attenuator, 20 GHz.

Opt.17/SMP-B17 – RF Attenuator, 40 GHz.

Opt. 18/SMP–B18 – Auxiliary Interface.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES – Also see page 438.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Generators
SMT

Features

SMT

- Frequency Range 5 kHz to 6 GHz (SMT06), 5 kHz to 3 GHz (SMT03), 5 kHz to 1.5 GHz (SMT02)
- Broadband FM Modulation from DC to 8 MHz with Deviation Up to 20 MHz
- Amplitude Modulation
- Phase Modulation (φM) from DC to 2 MHz
- Convenient RF, LF, and Level Sweeps
- Memory Sequence Function for Automatic Measurements
- Programmable Level Correction for Compensation of External Frequency Response
- Optional LF Generator (Opt. 02)
- Optional Pulse Modulator (with SMT06 Opt. 09, SMT03 Opt. 08, SMT02 Opt. 03)
- Optional Pulse Generator (Opt. 04)
- Optional Multifunction Generator (Opt. 06)
- Large, Backlit LCD Display
- All Submenus and Current Instrument Status Clearly Displayed
- Remote Control Interface IEC625/IEEE 488

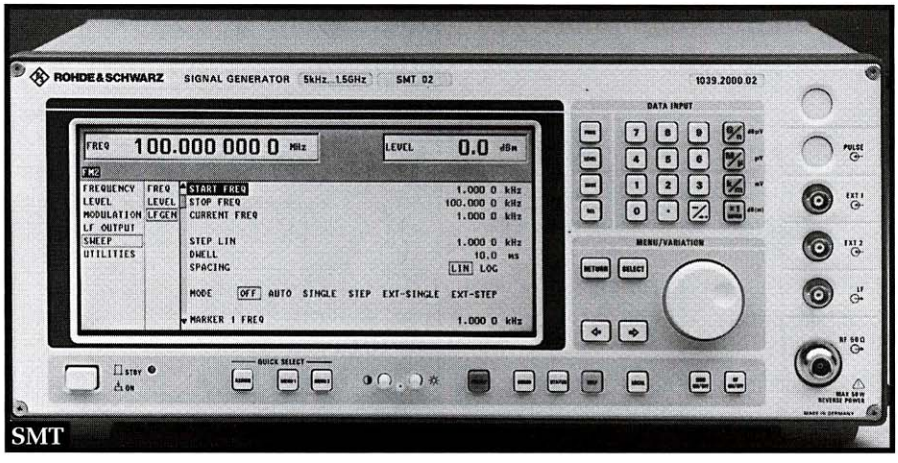
Applications

- Radar Applications (with SMT06 Opt. 09, SMT03 Opt. 08, SMT02 Opt. 03)
- VOR/ILS Receiver Tests (with Opt. 06)
- FM Broadcast Transmitter and Receiver Test and Design (with Opt. 06)

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987 with SCPI conformance.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



SMT Signal Generator

The SMT Signal Generator covers the complete range of conventional analog receiver measurements up to 6 GHz. It provides exceptionally high signal quality, outstanding level accuracy, a wide variety of modulation and signal generation modes, a customizable configuration, and ease of operation.

THE IDEAL EMS SIGNAL SOURCE
With a specified lower frequency limit of 5 kHz (under-range down to 1 kHz), the SMT fully covers the frequency range for EMS measurements stipulated by IEC 801. The digital, step-by-step sweep function, with preselectable start and stop frequency, span, step width, and step time, enables the convenient testing of wide frequency ranges. During the frequency sweeps, no level overshoots will occur. The sweep function can also be used for the RF level and AF frequency.

The frequency response of cables, amplifiers, TEM cells, etc., can be compensated in the signal generator by means of a level-correction function. Complicated external level controls or test routines are not required.

EXCELLENT RF CHARACTERISTICS AT A REASONABLE PRICE
For high-frequency measurements on AM, FM, and SSB receivers, the signal source must be superior to the device-under-test. The low residual FM and SSB phase noise of the SMT make it suitable for in-channel and blocking measurements, even on high-end receivers. The small level error of <1 dB throughout the frequency range allows high-precision sensitivity measurements.

MINIMUM RF EMISSIONS FOR SENSITIVE DUTS
Measurements on highly sensitive receivers such as pagers not only require high signal quality, but also extremely high RF shielding of the signal source. Elaborate shielding measures keep RF emissions of the SMT to a minimum.

MEMORY SEQUENCE FUNCTION FOR AUTOMATIC MEASUREMENTS
For frequently repeated measurement series, the memory sequence function allows a sequence of measurements to be run without an external controller. Up to 50 instrument settings can be stored in non-volatile memory.

See page 235 for characteristics.

Signal Generators
SMY

Features

SMY

- Frequency Range 9 kHz to 2.08 GHz (SMY02), 9 kHz to 1.04 GHz (SMY01)
- Frequency Resolution 1 Hz
- Level Range –140 to +13 dBm, Over Range up to 19 dBm
- Level Accuracy Better than 1 dB
- SSB Phase Noise <–114 dB at 1 GHz, Δf = 20 kHz
- AM, FM, φM, and Pulse Modulation
- Modulation Generator 1 Hz to 500 kHz
- RF Overload Protection 30 W (SMY01) or 50 W (SMY02)
- Low RF Leakage (<0.1 µV)
- Non-volatile Storage for up to 50 Complete Front-panel Setups
- Remote Control Interface IEC625/IEEE 488
- Calibration at 3-Year Interval

Applications

- Communications Receiver Testing
- General Component Measurements
- EMI

SMY

SMY Signal Generator

The SMY Signal Generator is a cost-effective instrument for testing AM, FM, and φM receivers and for component measurements. The SMY comes in two models: SMY01 for 9 kHz to 1.04 GHz and SMY02 for 9 kHz to 2.08 GHz.

The SMY Signal Generator is designed with a comprehensive set of basic signal generator capabilities. As a result, it's an economical solution for universal use in the lab, production, and servicing environments.

THE IDEAL GENERATOR FOR RECEIVER MEASUREMENTS...

Level range –140 dBm to +13 dBm (19 dBm over range) sufficient even for receivers of highest sensitivity.

High level accuracy and low RF leakage allowing accurate and undergraded sensitivity measurements.

FM DC with high accuracy of carrier frequency for testing pagers and receivers fitted with digital squelches.

Low SSB phase noise and high spurious rejection for all in-channel and blocking measurements.

Low residual FM affording ample margin for S/N measurements.

Modulation generator 1 Hz to 500 kHz for modulation frequency response measurements.

Stereo channel separation of 50 dB and low harmonic distortion for testing FM stereo receivers.

Non-interrupting level setting over a range of 20 dB for reproducible measurement of squelch hysteresis.

...PLUS THE PERFORMANCE FOR GENERAL-PURPOSE APPLICATIONS

Frequency resolution 1 Hz, also suitable for extremely narrowband tests.

FM DC deviation up to 20 MHz for VCO simulation.

FM bandwidth 2 MHz for fast FSK and telemetry applications.

High output level up to 19 dBm for component and overdrive testing.

AF synthesizer 1 Hz to 500 kHz, separate use as AF signal source possible for external applications (e.g., recording of AF frequency response).

Remote-control interface IEC625/IEEE 488 for use in automatic test systems.

Sequence function and SEQ input for semi-automatic use.

See page 235 for characteristics.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Generators
SMT • SMY

ANALOG SIGNAL GENERATOR SELECTION GUIDE

	SMT02	SMT03/SMT06	SMY01	SMY02
FREQUENCY				
Range	5 kHz to 1.5 GHz	5 kHz to 3 GHz (SMT03) 5 kHz to 6 GHz (SMT06)	9 kHz to 1.04 GHz	9 kHz to 2.08 GHz
Resolution	0.1 Hz	0.1 Hz	1 Hz	1 Hz
Accuracy @ 1 GHz	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year
Stability	±1 x 10^{-6}/year ±1 x 10^{-9}/day with Opt. 01	±1 x 10^{-6}/year ±1 x 10^{-9}/day with Opt. 01	±1 x 10^{-6}/year ±1 x 10^{-9}/day with Opt. 01	±1 x 10^{-6}/year ±1 x 10^{-9}/day with Opt. 01
Setting Time	<25 ms after IEEE delimiter	<25 ms after IEEE delimiter	<60 ms after IEEE delimiter	<60 ms after IEEE delimiter
OUTPUT LEVEL				
Range	+16 to –144 dBm	+16 to –144 dBm	+19 to –140 dBm	+19 to –140 dBm
Resolution	0.1 dB	0.1 dB	0.1 dB	0.1 dB
Accuracy	±1 dB	±1 dB to 1.5 GHz ±1.5 dB, ≥1.5 GHz ±2 dB, ≥3 GHz (SMT06 only)	±1 dB	±1 dB to 1.04 GHz ±1.5 dB, ≥1.04 GHz
SPECTRAL PURITY				
Harmonics	≤–30 dBc for levels ≤–10 dBm	≤–30 dBc for levels ≤–10 dBm	≤–30 dBc for levels <10 dBm	≤–30 dBc for levels <10 dBm
Spurious	≤–80 dBc	≤–80 dBc to 1.5 GHz ≤–74 dBc ≥1.5 GHz ≤–68 dBc, ≥3 GHz (SMT06 only)	≤–70 dBc	≤–70 dBc to 1.04 GHz ≤–64 dBc 1.04 to 2.08 GHz
Residual FM (0.3 to 3 kHz BW)	<8 Hz @ 1.5 GHz	<8 Hz to 1.5 GHz, <16 Hz 1.5 to 3 GHz <32 Hz to 6 GHz (SMT06 only)	10 Hz	10 Hz
SSB Phase Noise	–116 dBc/Hz @ 10 kHz offset and 1 GHz CF	–116 dBc/Hz @ 10 kHz offset and 1 GHz CF	–114 dBc/Hz @ 10 kHz offset and 1 GHz CF	–114 dBc/Hz @ 10 kHz offset and 1 GHz CF
MODULATION				
AM Frequency Range	DC to 100 kHz	DC to 100 kHz	DC to 50 KHz	DC to 50 KHz
AM Depth	0 to 100%	0 to 100%	0 to 100%	0 to 100%
FM Frequency Range	DC to 100 kHz or DC to 8 MHz	DC to 100 kHz or DC to 8 MHz	DC to 2 MHz	DC to 2 MHz
FM Max Deviation	±10 MHz	±20 MHz ±40 MHz (SMT06 only)	±10 MHz	±20 MHz
Phase Modulation	YES, dual channel, 100 kHz and 2 MHz BW	YES, dual channel, 100 kHz and 2 MHz BW	YES	YES
Phase Rate	0.4/1/3/15 kHz internal, DC to 2 MHz external	0.4/1/3/15 kHz internal, DC to 2 MHz external	1 Hz to 500 kHz	1 Hz to 500 kHz
Phase Deviation (maximum)	10 radians @ 100 kHz, 200 radians @ 2 MHz	10 radians @ 100 kHz, 200 radians @ 2 MHz	200 radians	400 radians
Pulse Modulation Generator	YES, with Opt. 04	YES, with Opt. 04	YES, external	YES, external
Pulse Width	20 ns to 1 s	20 ns to 1 s	–	–
Pulse Rate	100 ns to 85 s 0 to 10 MHz	100 ns to 85 s 0 to 10 MHz	–	–
Pulse Delay	20 ns to 1 s	20 ns to 1 s	2.5 µs	2.5 µs
On/Off Ratio	>80 dB	>80 dB	>80 dB	>80 dB
Rise/Fall Time	<10 ns	<10 ns	4 µs	4 µs
Simultaneous Modulation	YES	YES	YES	YES
Internal Modulation Generator	0.4/1/3/15 kHz	0.4/1/3/15 kHz	1 Hz to 500 kHz	1 Hz to 500 kHz
VOR Modulation Signal	YES, with Opt. 06	YES, with Opt. 06	NO	NO
ILS Modulation Signal	YES, with Opt. 06	YES, with Opt. 06	NO	NO
Stereo Multiplex Signal	YES, with Opt. 06	YES, with Opt. 06	NO	NO

Signal Generators
SMT • SMY

ANALOG SELECTION GUIDE (CONTINUED)

	SMT02	SMT03/SMT06	SMY01	SMY02
SWEEP				
Functions	Digital, in discrete steps, linear or log	Digital, in discrete steps, linear or log	NO	NO
Modes	Automatic, manual, single-shot and external triggered	Automatic, manual, single-shot and external triggered	NO	NO
Start/Stop	YES	YES	NO	NO
Center Frequency, Delta Frequency	YES	YES	NO	NO
Markers	3	3	NO	NO
OTHER FEATURES				
IEEE-488 Interface	YES	YES	YES	YES
Self-diagnostics	YES	YES	NO	NO
Overload Protection	50 W max RF, 35 V max DC	50 W max RF, 35 V max DC	30 W max RF, 35 V max DC	50 W max RF, 35 V max DC
POWER REQUIREMENTS				
Line Voltage	90 to 132 V, 180 to 265 V	90 to 132 V, 180 to 265 V	100 V/230 V	100 V/230 V
Line Frequency	47 to 440 Hz	47 to 440 Hz	47 to 440 Hz	47 to 440 Hz
ENVIRONMENTAL				
Operating Temperature	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C
Mechanical Stress	MIL-STD 810D	MIL-STD 810D	MIL-STD-T 28800D Class 5	MIL-STD-T 28800D Class 5
Electromagnetic Compatibility	MIL-STD 461 B, RE02, CE03, CS01, CS02	MIL-STD 461 B, RE02, CE03, CS01, CS02	EN 50081-1, EN 50082-1 compliance	EN 50081-1, EN 50082-1 compliance
PHYSICAL				
Dimensions	**mm in.**	**mm in.**	**mm in.**	**mm in.**
Height	192 7.89	192 7.6	147 5.79	147 5.79
Width	435 17.8	435 17.8	435 17.12	435 17.12
Depth	480 18.9	365 14.38	350 13.8	460 18.1
Weight	**kg lb.**	**kg lb.**	**kg lb.**	**kg lb.**
Net	20 44	20 44	11 24	12 26

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SMT06
Signal Generator (5 kHz to 6 GHz).
Includes: Power Cord, Operating Manual.

SMT03
Signal Generator (5 kHz to 3 GHz).
Includes: Power Cord, Operating Manual.

SMT02
Signal Generator (5 kHz to 1.5 GHz).
Includes: Power Cord, Operating Manual.

Opt. 01/SM-B1 – OCXO Reference Oscillator.
Opt. 02/SM-B2 – LF Generator.
Opt. 03/SM-B3 – (SMT02) Pulse Modulator.
Opt. 04/SM-B4 – Pulse Generator.
Opt. 06/SM-B6 – Multifunction Generator.
Opt. 08/SM-B8 – (SMT03) Pulse Modulator.
Opt. 09/SM-B9 – (SMT06) Pulse Modulator.
Opt. 20/SMT-B19 – Rear-panel Connectors for RF and AF.

SMY01
1.04 GHz Signal Generator.
Includes: Power Cord, Operating Manual.

SMY02
2.08 GHz Signal Generator.
Includes: Power Cord, Operating Manual.
Opt. 01/SMY-B1 – OCXO Reference Oscillator.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES – Also see page 438.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI/RFI Solutions

EMI/RFI Solutions – An Introduction

Electrical and electronic devices may emit signals which interfere with other devices, or even with themselves. These signals are known as electromagnetic interference (EMI) or sometimes as radio frequency interference (RFI). Conversely, the ability of a device to withstand emissions from other devices or from itself is called immunity. The inverse of immunity is electromagnetic susceptibility (EMS).

As the number of electronic devices in use increases, so does the potential for these devices to interfere with each other. Electromagnetic compatibility (EMC) is a measure of how well they share their electromagnetic environment without adverse affects from EMI.

The goal of EMC is to construct electrical equipment with sufficiently low emissions and sufficiently high immunity to guarantee electromagnetic compatibility. The definition and enforcement of "sufficiently high" and "sufficiently low" becomes a matter of standards and regulations. In fact, when we refer to EMC compliance, we generally mean the ability of a system or device to meet standards regulating the amount of EMI that it can emit and its immunity to EMI.

EMC/EMI is a vital concern to manufacturers of electrical equipment subject to compliance. Their products must meet the applicable standards before they can be marketed. To ensure electromagnetic compatibility, the necessary measures should, therefore, be considered as early in the design phase as possible so they can be implemented in product development.

EMI

Electromagnetic interference or emissions from an electrical or electronic device may significantly impair radio and TV reception in the vicinity. While this is clearly an annoyance, an even greater concern is interference to navigation and communications equipment on board aircraft.

To prevent such a critical situation and to allow a wide variety of devices to operate next to and with each other, it's important to define interference limits ensuring a sufficient safety margin between EMI emissions and EMS limit values. Depending upon the standard being applied and the limit class required, different test conditions have to be observed in interference measurements. Test measurements are made either in shielded rooms or at an open-area test site as required. It is important that the measuring instruments themselves should not influence the result.

EMS

EMS measurements are made to test the function of a module, instrument, or system under the influence of conducted or radiated interference. These measurements must be carried out in shielded rooms or anechoic chambers. RF absorbers in the test chamber prevent erroneous results and simulate open-site conditions at high frequencies.

FIELD-STRENGTH AND RADIO MONITORING MEASUREMENTS

Radiocommunications services (PTT, broadcasting corporations, military, traffic and security authorities, as well as civil services) use field-strength meters for propagation measurements in the planning stage and for coverage measurements during operation of communication networks.

Field-strength measurements – in particular, propagation and coverage measurements – are usually made in mobile mode (vehicle or aircraft). Therefore, portability and DC or battery operation are important criteria in the choice of a test receiver.

Radio monitoring services use test receivers to check emissions for compliance with the specifications. Test parameters include field-strength, wave propagation, spurious responses, frequency, occupied bandwidth, frequency deviation, and amplitude modulation depth, as well as channel and band occupancy.

CONTENTS

EMI/RFI SOLUTIONS

27120A – Pre-/Post-certification Measurement System 239

EMC120 – EMI Precompliance Test Software.....239

2706 – Stepping RF Preselector.....343

EMC ANCILLARY DEVICES

Antennas, Transducers, and Related Devices for EMI Testing 245

EMI FIELD STRENGTH

ESBI and ESMI EMI Test Receivers – EMI Test Receiver with Built-in Spectrum Display.....246

EMI/RFI SOLUTIONS

ESHS, ESVS, ESS EMI Test Receivers – Conventional EMI test receiver for testing to all relevant commercial and MIL-STD specifications 250

EMI/RADIO MONITORING SOLUTIONS

ESVB, ESVD, ESVN, ESN Test Receivers – Test receivers for field strength and radio monitoring 258

EMI SOFTWARE

ES-K1 Software – EMC compliance test software for use with all Rohde & Schwarz EMI test receivers ...263

EMI TEST RECEIVER

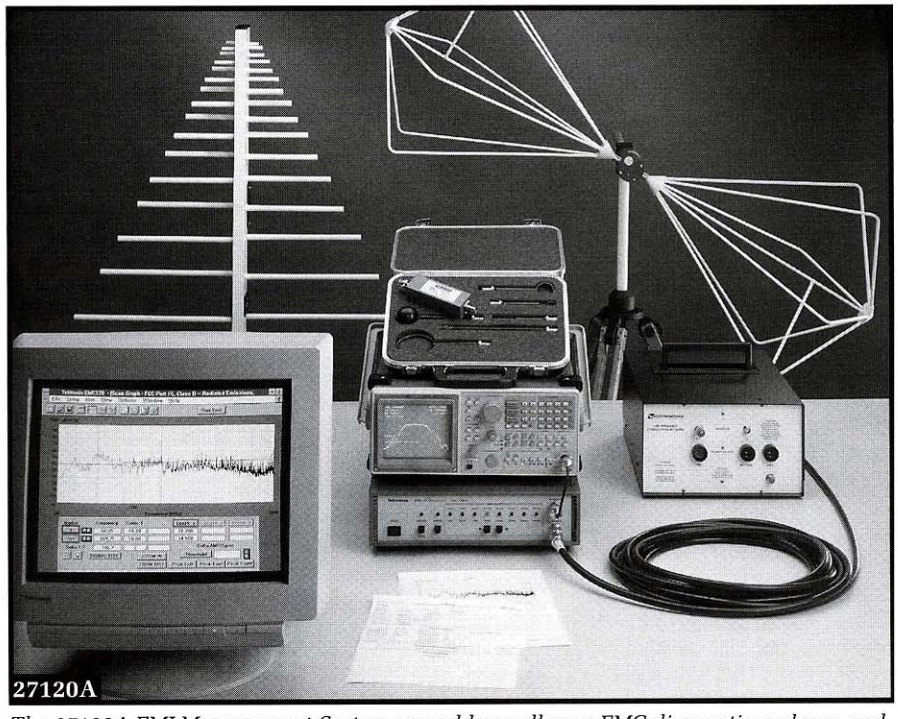
ESPC Test Receiver.....264

27120A EMI Measurement System

EMC120 Windows Software

Features

- A Complete System Designed To Meet Your EMI Testing Needs
- Diagnose and Correct "Hot Spots" Using the 2712 and Near-Field Probes
- Includes LISN and Transient Limiter for Conducted Emissions Measurements
- Includes Antennas, Tripod, and Cable for Radiated Emissions Measurements
- Built-in 2712 Preamp Provides Low Noise Floor for Tight Spec Limits
- 2706 RF Preselector Protects Against Signal Overload
- Powerful EMC120 Software Saves Time in Acquiring Data and Preparing Engineering Reports



The 27120A EMI Measurement System can address all your EMC diagnostic and pre- and post-certification needs.

Maximize the probability that your product will be certified the first time through the EMC test lab! Minimize costly delays resulting from retesting your products! Ensure continued compliance throughout your product's life-cycle!

The time to address compliance is before it becomes a problem. Proper attention to EMC, from the design stage through pre-certification testing, can reduce your product development cost and decrease your time to market.

Achieve these objectives and more with the Tektronix 27120A EMI Measurement System – a complete solution for EMI pre- and post-certification of your products. The heart of the system is the easy-to-use 2712 Option 12 Spectrum Analyzer. It includes many features helpful in identifying and measuring EMC signals:

- Internal preamp
- Frequency counter
- AM/FM demodulator
- True analog display
- 4-trace digital display
- Peak, Quasi-peak, and Average detection
- 200 Hz, 9 kHz, 120 kHz EMC filters

Overload capability is enhanced and ambient signal interference is minimized by the 2706 Stepping RF Preselector. This may be controlled manually or automatically, via IEEE 488 interface, by the EMC120 software.

For diagnostic work, the 27120A provides a set of two E-field probes, three H-field probes and an extender. These allow you to quickly locate the source and frequency of radiation.

Conducted emissions measurements are made with a 25 A LISN (Line Impedance Stabilization Network) and a Transient Limiter. Radiated emissions measurements are made with a biconical antenna and log-periodic antenna. A tripod and 10 m low-loss cable are also provided.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

27120A EMI Measurement System

EMC120 Windows Software

The new EMC120 Windows-based software is a feature-filled package that takes the drudgery out of EMC testing. It does everything from data acquisition, to correcting for transducer factors, to graphing and printing final test results.

An automated EMI test system is only as good as the software that runs it. The new EMC120 EMI Precompliance Test Software strikes a proper balance between powerful features and ease-of-use. For the new user, there's a HELP Wizard that prompts for the primary steps necessary to define a conducted or radiated test. There's also a complete on-line manual that's available at the click of a mouse. No longer is it necessary to consult printed manuals to understand how the software works. For the advanced user, there's a complete test setup screen that allows the important spectrum analyzer parameters to be defined.

The EMC120 package is optimized for the Tektronix 2712 Option 12 Spectrum Analyzer, but it also runs with a standard 2712, or a 2711. The EMC120 automatically controls the Tektronix 2706 Preselector by switching to the appropriate 2706 filter setting as the test is being run.

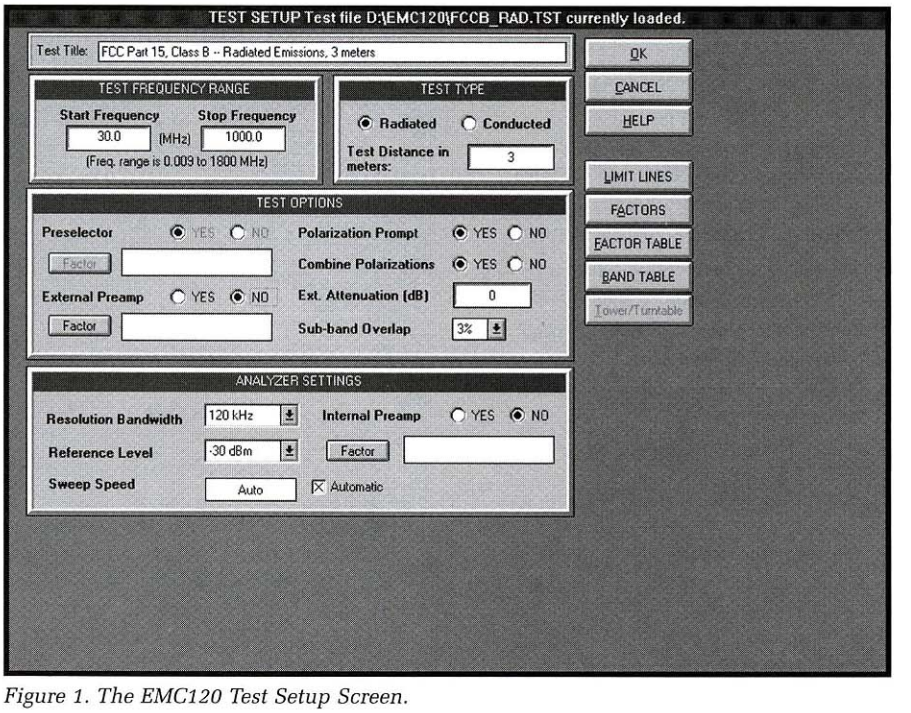


Figure 1. The EMC120 Test Setup Screen.

FILE OPERATIONS

A library of typical test routines, with commonly used limit lines, is provided with the software. These support commercial testing according to standards such as CISPR 11, CISPR 22, FCC Part 15 (Class A and B), and the European Norms standards. You can either define a new test from scratch, open a file for an existing test, or modify an existing test and save it to disk. User-defined limit lines can be easily created or modified and saved to disk.

The EMC120 Software also has the ability to store and recall acquired data to/from disk. Either one or two stored data sets can be recalled and graphed on the PC display screen. Using the Import Data function, it's also possible to read in scan data previously acquired via S26EM12, a Tektronix DOS-based EMI software package.

TEST SETUP

The Test Setup screen (see Figure 1) was designed so that commonly used spectrum analyzer test parameters are readily accessible. These include items such as the Start/Stop Frequency, Reference Level, Resolution Bandwidth, and Sweep Speed. A frequency-band table allows precise control over each acquisition window on the 2712. This software also supports either an external preamp or the internal 2712 preamp, thereby increasing the noise margin relative to stringent EMC limit lines.

Limit lines and correction factors are created in an intuitive spreadsheet-style format. Graphs of these limit lines and correction factors may be displayed on the PC screen or sent to an external printer. Up to 10 different correction factor files can be added together in the software that will be used to correct the data. Up to three limit lines can be simultaneously displayed on the graph of the final data.

The Test Setup screen also allows control of an Electro-Metrics automated mast and turntable.

27120A EMI Measurement System

EMC120 Windows Software

RUNNING THE TEST

Three detector modes are available when using a 2712 Option 12: Peak, Quasi-peak, and Average (the Average detector is simulated via the 2712 video filter). During Peak testing, data may be accumulated in Maxhold mode over a specified number of sweeps, or the data may be accumulated continuously until terminated by the user. Data can also be acquired periodically at specified time intervals – this is useful for radio monitoring and ambient testing. The Quasi-peak and Average tests allow the dwell time to be set so that intermittent signals can be captured.

All data is stored in an internal data base using one of three options: Auto-save (append new scan to previous scan), Prompt (save each scan to a specified file) or Auto-overwrite (erase previous scan and store new scan). When recalling Auto-saved data, the user can specify either one or two scans to graph on screen.

VIEWING THE DATA

As a test is being run, data is graphed as it is acquired. Once a test has completed, it's possible to enable one or two markers which provide absolute or relative frequency/amplitude values. These markers may be used to highlight selected portions of the graph so that a Zoom-in operation can be performed. Successive Zoom-in operations allow the user to examine signals in greater detail.

There are also three peak find buttons. A Threshold button allows setting a level below which signals will be ignored. The user has complete control over the display of the graph. The color of each graph element is user-definable, and the frequency scale may be set to either Log or Linear. Data may be graphed according to a fixed set of amplitude limits, or by auto scaling the data.

If a Quasi-peak or Average test is being run, the graph is drawn and a window with Suspect Signals pops up on screen. You can then run a test on each of these signals, or edit the list (add or delete signals) prior to executing the QP or Average test.

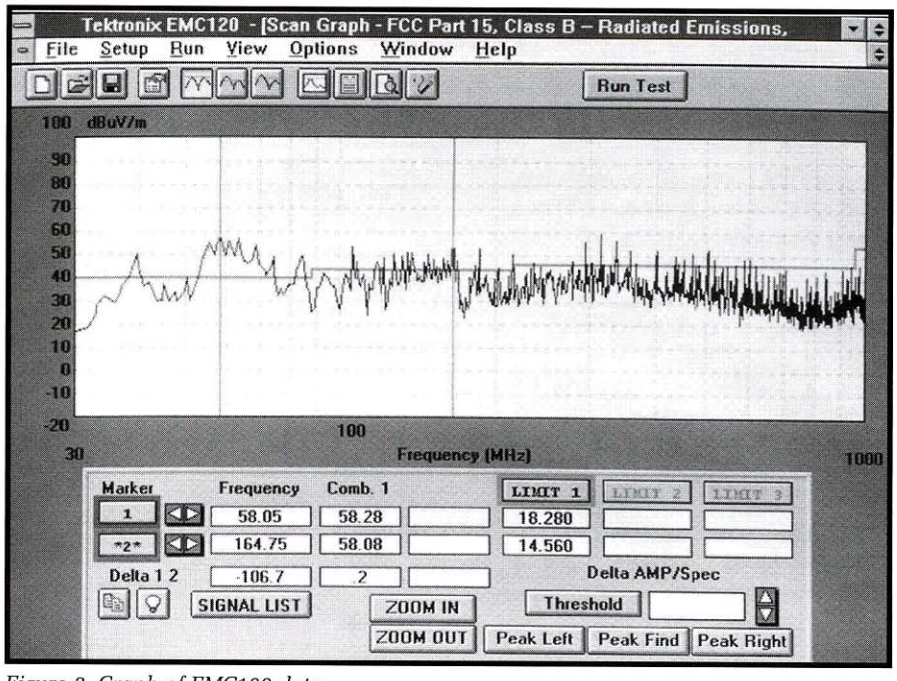


Figure 2. Graph of EMC120 data.

REPORT GENERATION

EMC120 Software has a very versatile report generator. Each of the columns in the tabular report is user definable and can include elements such as the frequency of the signal, the peak amplitude, the limit line, etc. The report may be displayed on screen or sent to a printer.

PASS/FAIL CRITERIA

The software contains a report threshold that operates with respect to the primary limit line. For example, if a value of 10 dB is specified, any signal that is greater than 10 dB below the limit line will be reported. This feature allows the user to effectively select a "pass/fail" criteria for equipment being tested.

SYSTEM REQUIREMENTS

EMC120 Software runs on a PC-compatible computer equipped with a National Instruments GPIB (IEEE 488.2) card. A 486/33 or faster processor with at least 8 Mb of RAM is recommended. A VGA monitor and hard disk with at least 10 Mb of free space is required.

27120A EMI Measurement System

EMC120 Windows Software

27120A EMI Measurement System

Following are the primary specifications and features for the individual components that make up the 27120A.

2712 OPTION 12 SPECTRUM ANALYZER
Frequency Range – 9 kHz to 1.8 GHz.

Center Frequency Accuracy – 5 x 10–7 of CF ±700 Hz.

Flatness (with 10 dB internal RF Attenuation) – ±1.5 dB (Preamp Off).

Features –
Quasi-peak detector and EMC filters.
Built-in frequency counter.
True analog plus four-signal digital display.
Built-in antenna factor tables.
AM/FM demodulators standard.

2706 STEPPING RF PRESELECTOR
Frequency Range – 9 kHz to 1.8 GHz.

Bandpass/Highpass Filters – Eight spanning the full frequency range.

Insertion Loss – 3 dB <1 GHz.

Ultimate Rejection – Typically 60 dB below 500 MHz and 30 dB min. above 500 MHz.

Features –
Single-switch bypass function.
Manual or GPIB control.

LISN
Facilitates conducted emissions.

Frequency Range – 9 kHz to 100 MHz.

Features –
Includes 50 Ω terminator.
5 Ω/5 mH measurement circuit.
250 mH choke to attenuate noise on incoming mains.

Power Line – DC to 400 Hz, 25 A max. continuous, two lines.

TRANSIENT LIMITER
Use with LISN to prevent inadvertent damage to spectrum analyzer.

Input Power – 10 W average, 10 kW for 10 µs transients.

Attenuation – Constant 10 dB ±0.5 dB from 9 kHz to 100 MHz.

ANTENNAS
Only two antennas required to cover the entire EC/FCC 1 GHz radiated measurement range.

Biconical – Useable from 20 MHz to 300 MHz.

Log Periodic – Useable from 200 MHz to 1 GHz.

Features –
Hard copy and disk-based antenna factors included.
Eliminates need for dipole element switching, extension, tuning.

EMC120 TEST SOFTWARE
System Requirements – PC-compatible computer equipped with a National Instruments GPIB (IEEE 488.2) card. 486/33 or faster processor with at least 8 Mb of RAM. A VGA and hard disk with at least 10 Mb of free space is required.

NOTE: The 27120A does not include a GPIB controller or GPIB cables. These are available from Tektronix. For more information, contact your nearest Tektronix Field Office, or call 1-800-TEK WIDE.

RF PROBE SET
Useable to 1 GHz.
3 H-field probes.
2 E-field probes.
Extension.
Case.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

27120A EMI MEASUREMENT SYSTEM
Includes: 27120A System Manual and individual component instrument manuals.

27120A SYSTEM OPTIONS
Option 05 – Add 2707 External Tracking Generator. Useable for site attenuation and filter design and evaluation.
Frequency Range: 100 kHz to 1.8 GHz.
Output Level: –48 to 0 dBm.

Option 10 – Add television demodulation. Useful for signal identification. Includes broadcast (AM) and satellite (FM) demodulation.

Option 11 – Delete antennas, tripod, and cable when system used for conducted measurements only.

Option 16 – Delete LISN and Transient Limiter when system used for radiated measurements only.

Option 17 – Delete 2706 RF Preselector.

International Power Plug Options

Option A1 – Universal Euro 220 V, 50 Hz.

Option A2 – UK 240 V, 50 Hz.

Option A3 – Australian 240 V, 50 Hz.

Option A4 – North American 240 V, 60 Hz.

Option A5 – Switzerland 220 V, 50 Hz.

EMI MEASUREMENT SOFTWARE
EMC120 Software
Includes: Instruction manual and four 3.5 in. floppy disks.

EMC120U SOFTWARE UPGRADE PACKAGE
Upgrades S26EM12 Software to EMC120 Software.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

EMI/RFI Solutions

2706

Features

2706

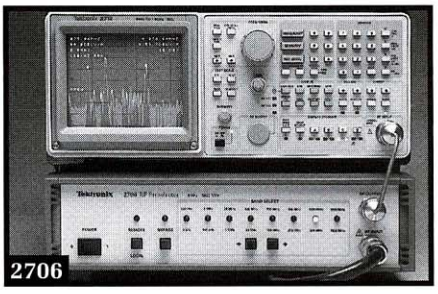
- Low Investment
- Easy to Use
- Part of Automated Measurement System Using Tektronix EMC120 EMI Software
- Bypass Mode Facilitates Measurement Without Preselection
- Can Be Easily Taken to Remote Measurement Sites
- Can Be Used As a Standalone Filter in Many Other Applications
- 9 kHz to 1800 MHz Overall Range (Bypass Mode)
- Continuous Bandpass Filtering from 9 kHz to 1800 MHz in Eight Selectable Bands
- Compact, Lightweight Design
- Attaches to the Tektronix 271X Spectrum Analyzers to Form Integrated Unit
- UL Listed 1244, Certified CSA C22.2 No. 231-M89

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*



2706 Preselector

The 2706 Stepping RF Preselector facilitates distortion-free measurements in the presence of large signals at the spectrum analyzer input. If total signal power at the first mixer stage of the spectrum analyzer exceeds the 1 dB compression point, inaccurate amplitude measurements and spurious intermodulation products can result. The 2706 Preselector enables the spectrum analyzer user to make accurate measurements over a wider range of signal environments by:

- Significantly attenuating undesired out-of-band signals
- Reducing energy from high amplitude, short duration pulses
- Minimizing the total number of individual signals present at the analyzer input

Use of commercial RF preselectors has been limited because of high costs. Now Tektronix offers an affordable and cost-effective solution for pre-certification testing.

The Tektronix 2706 Stepping RF Preselector is designed to be used with spectrum analyzers for EMI measurements and other applications. The 2706 can be attached to the bottom of 271X Spectrum Analyzers to form a single compact unit. Signals present at the 2706 input connector are routed directly to the spectrum analyzer when preselection is not desired. When preselection is desired, one of eight bandpass filters is switched into the circuit to limit the range of frequencies passed to the analyzer.

The 2706 is a stepping RF preselector using band switching to select the desired range of frequencies. Manual operation is possible from the front panel, and remote operation is provided via a GPIB interface which is supported by Tektronix EMC120 EMI Software. While not equivalent to a narrow-band tracking preselector, the 2706 does an excellent job of rejecting out-of-band signals and decreasing overload susceptibility at a small fraction of the cost of a narrow-band tracker.

Characteristics

FREQUENCY RELATED

Bypass Mode – Frequency Range: 9 kHz to 1800 MHz. Insertion Loss: 3 dB <1 GHz.

Filters – Frequency Range: 9 kHz to 1800 MHz in eight switch-selectable ranges. Bandpass/Highpass Flatness: 1.5 dB max.

INPUT RELATED

RF Input/Output Connectors – Type N.

Input/Output Impedance – 50 Ω nominal.

VSWR (max) – 1.8:1.

Ultimate Rejection, Stop Band – 60 dB typical. 40 dB min. below 500 MHz and 30 dB min. above 500 MHz.

Maximum Input – +20 dBm, 50 V DC.

Switching Speed (max) – 10 ms.

IEEE 488 Interface Support – AH1, L4, SH1, T6, SR1, PP1, DC1, DT0, RL1, C0, E1, TE0, and LE0.

GENERAL CHARACTERISTICS

Power Requirements – 90 to 250 V AC, 48 to 63 Hz, 10 W max.

PHYSICAL CHARACTERISTICS

Dimensions	cm	in.
Width	32.7	12.87
Height	8.8	3.46
Depth	43.1	16.97
Weight	**kg**	**lb.**
Net	5.9	13

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

2706
Stepping RF Preselector.
Includes: Power Cord (U.S. 115 V, 60 Hz), Operator's Manual.

271X Spectrum Analyzer Mounting Hardware and RF Interconnect Cable– Order 118-8800-00.

MEASUREMENT SERVICE OPTIONS

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

SOFTWARE

See page 201 for complete description.

Commercial EMI Test Software – Order EMC120.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

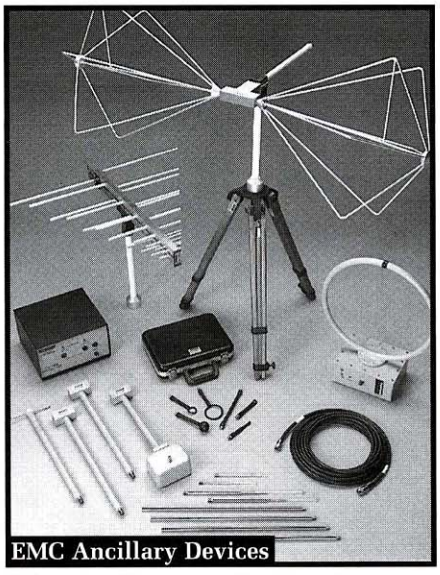
See Customer Information Section for additional description.

EMC Ancillary Devices

Features

EMC ANCILLARY DEVICES

- Active Loop Antenna
- Adjustable-length Dipoles
- Biconical Antenna
- Log-periodic Antenna
- RF Near-field Probe Set
- LISN
- Transient Limiter
- 10 m Low-loss Coaxial Cable
- Adjustable Tripod



Tektronix offers a complete line of calibrated antennas and other sensor products for EMI testing.

Sensors or transducers are required for EMI signal reception. The sensor picks up the EMI signal and couples it to the spectrum analyzer. The spectrum analyzer then displays the EMI signal as a plot of amplitude (vertically) versus frequency (horizontally).

The type of sensor needed depends on the test standard and the nature of the test (radiated or conducted electric field, or radiated magnetic field). For radiated electric (E) field tests, a biconical, log periodic, or dipole antenna may be used. Electrostatically shielded loop antennas are used for magnetic (H) field tests.

The specific transducer type required also depends on the test standard and frequency range. Tektronix has available a line of antennas and other sensors, as shown in the figure at left.

For conducted measurement, Tektronix offers a Line Impedance Stabilization Network (LISN). It is inserted between the AC power source and the EUT. Outputs on the LISN couple the EMI emitted by the EUT to the spectrum analyzer's input.

Our complete line of ancillary devices is listed in the ordering information below.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

LOOP ANTENNA
9 kHz to 30 MHz. Order No. 119-4144-00.
Application Information: Radiated H-field (magnetic) emissions. Active loop provides gain and low-frequency sensitivity.

ADJUSTABLE-LENGTH DIPOLES
28 MHz to 1 GHz. Order No. 119-4145-00.
Application Information: Radiated E-field emissions/CATV leakage. Ideal for EMI testing and site attenuation measurements. Includes four baluns.

BICONICAL ANTENNA
30 MHz to 300 MHz. Order No. 119-4148-00.
Application Information: Radiated E-field emissions. Broadband frequency capability eliminates need for band switching, element extension, or external tuning.

LOG-PERIODIC ANTENNA
200 MHz to 1 GHz. Order No. 119-4142-00.
Application Information: Radiated E-field (electric) emissions. Linearly polarized design permits separate measurement of horizontal and vertical fields. Broadband frequency.

RF PROBE SET
9 kHz to 1.8 GHz. Order No. 119-4146-00.
Application Information: Locates RF "Hot Spots." Useful in diagnostic testing. Includes five probes (3H-field, 2 E-field) plus extension.

LISN
10 kHz to 100 MHz. Order No. 119-4147-00.
Application Information: Facilitates measurement of conducted emissions on power line from equipment under test. Filters undesired signals imported on mains supply.

TRANSIENT LIMITER
9 kHz to 100 MHz. Order No. 011-0164-00.
Application Information: Use with LISN to prevent inadvertent damage to spectrum analyzer input.

10 M COAXIAL CABLE
Order No. 012-1291-00.
Application Information: Couples antenna to spectrum analyzer (male fittings).

ADJUSTABLE TRIPOD
Order No. 016-1102-00.
Application Information: Mounting for all above antennas. Wooden frame reduces field disturbance.

EMI, Field Strength

ESBI • ESMI

Features

ESBI/ESMI

- 20 Hz to 5 GHz Frequency Range (ESBI)
- 20 Hz to 26.5 GHz Frequency Range (ESMI)
- RF Level Switchable from 0 to 120 dB in 2 dB Steps (ESMI, 0 to 75 dB in 5 dB steps)
- Preselector with Eleven Filters with Fixed Tuning and Four Tracking Filters
- Low-noise Preamplifier with Wide Dynamic Range Fitted Between Preselector and First Mixer
- Parallel Detectors for Peak, Quasi-peak, Average, and RMS Weighting
- Overload Detectors at the Mixers and in the RF and IF Signal Paths to Avoid Incorrect Measurements and to Ensure Optimum Setting in the Autorange Mode

Applications

Conforms to following industrial and military standards:

COMMERCIAL:

- CISPR
- VDE
- FCC
- EN
- VCCI

MILITARY:

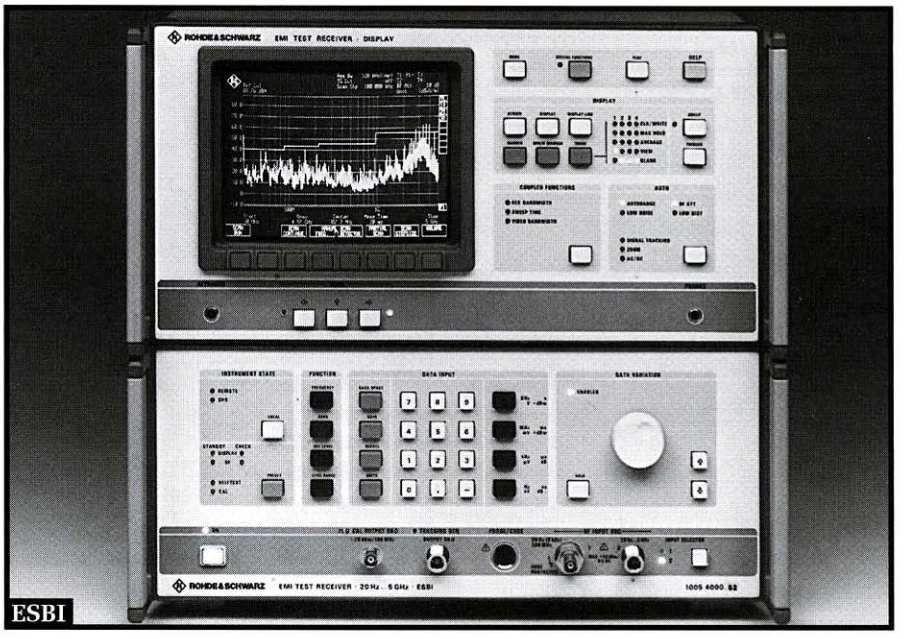
- MIL-STD
- DEF-STAN
- BS
- DO 160
- GAM EG 13

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



ESBI

Introduction

The ESBI and ESMI EMI Test Receivers combine world-class EMI specifications with the performance of high-speed spectrum analyzers. Integral measurement and analysis functions simplify and speed up measurements to the relevant commercial and military standards.

LARGE DYNAMIC RANGE AND HIGH SENSITIVITY

The ESBI and ESMI EMI Test Receivers feature a large dynamic range and high sensitivity. Moreover, the test receiver settings completely conform to CISPR requirements, i.e., the dynamic range is large enough to allow correct weighting of single pulses.

Refined preselection filtering provides the required large dynamic range for wideband signals. A low-noise preamplifier, which can be switched after the preselector, is used to increase sensitivity. To measure high-energy pulses, a second input is provided which can handle pulses in the frequency range from 20 Hz to 200 MHz. An automatic overload detector checks sensitive points in the signal path.

SIGNAL ANALYSIS

These EMI receivers have a variety of maximum, minimum, average, RMS, and quasi-peak detectors for simultaneous signal analysis. Built-in AM/FM demodulators allow audio monitoring of interference signals.

A pulse calibration source for checking the CISPR weighting curves is provided in addition to the built-in sine calibration source. This ensures extremely high measurement accuracy. A tracking generator for EMC measurements covering the entire range of the receiver is also available.

OVERVIEW MODE SPEEDS ANALYSIS

In the OVERVIEW mode, the whole interference spectrum is displayed on the screen of the test receivers. The IF resolution bandwidths can be adjusted to CISPR standards; the IF selectivity also has a quasi-analog setting mode to optimize the sweep time. The interference spectrum can be displayed on the screen using a linear or logarithmic frequency scale. A maximum of eight different limit lines can be displayed on the screen. Out-of-limit values are automatically detected and displayed.

FAST, FLEXIBLE SCAN

In the SCAN mode the ESBI and ESMI function in a way that is comparable to a conventional test receiver. In addition to measurements at the selected frequency, automatic scans between a start and a stop frequency at an adjustable step size are possible. Manual adjustments, which can be made while the scan is in progress, and repeat measurements over selectable subranges reduce the time required for complete EMI measurements.

EMI, Field Strength
ESBI • ESMI

To conform with relevant standards, measurements have to be made over various frequency ranges and bandwidths. For this purpose, the user can define a variety of frequency ranges in a configuration table. Measurements are then made over these subranges using the selected bandwidth measurement, time, step size, etc.

SPLIT-SCREEN DISPLAY
The results are displayed in two windows obtained by splitting the screen display horizontally. Different traces, and thus the results from different detectors, can be displayed in the upper and lower windows. This is ideal for showing narrowband and broadband signals simultaneously.

AUTOMATIC TRANSDUCER COMPENSATION
The test results are always displayed with correct units (dBµV, dBµV/m, dBµA, etc.). Correction factors for the transducers designed specifically for the ESBI and ESMI are entered into a transducer table and used to automatically compensate for the frequency dependence of the transducer factor. A maximum of four correction-factor tables are available and can be used independently or combined.

DOCUMENT TEST RESULTS TO PRINTERS AND PLOTTERS
Test results can be output to a wide range of printers and plotters to provide clear documentation of measurement results. The ESBI and ESMI support monochrome and color hardcopy devices including laser printers and plotters.

Characteristics

FREQUENCY RELATED

Frequency Range – ESBI: 20 Hz to 5 GHz; ESMI: 20 Hz to 26.5 GHz (to 110 GHz with external mixers).

Frequency Setting – By step keys and spinwheel. Frequency Resolution: 1 Hz. Error of Frequency Reference: $<1 \times 10^{-7}$; Frequency Scale: Selectable LIN/LOG.

Frequency Display – Error (span >5 MHz, Sweep Time <100 ms): $<8 \times 10^{-3}$ x span.

Frequency Span – Range: ESBI: 10 Hz to 5.2 GHz; ESMI: 10 Hz to 26.5 GHz; Error: Span 10 Hz to 5 MHz: $<2 \times 10^{-3}$ x span; Span >5 MHz: $<5 \times 10^{-3}$ x span.

Frequency Counter – Scan setting: <1000 x resolution bandwidth; Resolution: 0.1 Hz to 10 kHz; Error limit: <readout x 10^{-7} ±2 x resolution.

Spurious with Discrete Frequencies – n x Mains Frequency: >70 dBc; m x Line Frequency (26.4 kHz): >80 dBc; 100 kHz (span ≤5 MHz): >90 dBc; –10.7 MHz: >90 dBc; Other for Δf >1 MHz: >75 dBc.

Internal Spurious Response (input terminated with 50 Ω) – f >1 MHz: <–110 dBm (<–3 dBµV); f <1 MHz, f >4.7 GHz, f = 1.585 GHz: <–95 dBm (<12 dBµV); Oscillator feedthrough: –25 dBm typical.

FILTERS

RF Preselector – Selectable filters (except YIG filter in ESMI), automatically switched.

	Passband frequencies from/to		Filter Type
Filter 1	DC	9 kHz	LP, fixed
Filter 2	9 kHz	150 kHz	BP, fixed
Filter 3	150 kHz	2 MHz	BP, fixed
Filter 4	2 MHz	10 MHz	BP, fixed
Filer 5	10 MHz	30 MHz	BP, fixed
Filter 6	30 MHz	50 MHz	BP, fixed
Filter 7	50 MHz	80 MHz	BP, fixed
Filter 8	80 MHz	110 MHz	BP, fixed
Filter 9	110 MHz	140 MHz	BP, fixed
Filter 10	140 MHz	260 MHz	BP, tuned
Filter 11	260 MHz	450 MHz	BP, tuned
Filter 12	450 MHz	700 MHz	BP, tuned
Filter 13	700 MHz	1 GHz	BP, tuned
Filter 14	1 GHz	1.9 GHz	BP, fixed
Filter 15 (ESBI)	1.9 GHz	5.2 GHz	BP, fixed
Filter 15 (ESMI)	1.9 GHz	5.0 GHz	BP, fixed
Filter 16 (ESMI)	4.9 GHz	26.5 GHz	YIG filter

NOTE: The 6 dB bandwidth of the tunable bandpass filters is typically <85 MHz, that of the YIG filter increases from typically 50 MHz at 5 GHz to typically 100 MHz at 26.5 GHz.

IF Filters – Overview mode (3 dB bandwidths): <10 Hz (6 Hz typical) to 3 MHz in 5% steps (except 30 to 80 kHz).
EMI receiver mode (6 dB bandwidths): 10 Hz*1, 100 Hz, 200 Hz, 1 kHz, 9 kHz, 10 kHz, 100 kHz, 120 kHz, and 1 MHz.
Bandwidth factor: –60 dB/–3 dB: <12.
–80 dB/–3 dB: <20.

Video Filters (1st order RC lowpass after IF rectifier) – Bandwidths (–3 dB): 1 Hz to 3 MHz in 1, 3, 10 steps.

*1 *Ambient temperature 15 to 35°C.*

AMPLITUDE RELATED

Maximum Input Level – DC voltage:
DC coupling: <0 V; AC coupling: <20 V.
AC voltage (sinewave): RF attenuation 0 dB: <20 dBm (100 mW; 127 dBµV); RF attenuation ≥10 dB: <30 dBm (1 W; 137 dBµV);
Pulse spectral density (RF attenuation 0 dB):
RF preselector on: f <150 kHz: <130 dBµV/MHz;
f = 150 kHz to 1 GHz: <90 dBµV/MHz;
f ≥1 GHz: <61 dBµV/MHz.
RF preselector off: <61 dBµV/MHz.
Maximum pulse voltage (RF attenuation ≥10 dB): Input 1: <150 V; Input 2: <50 V.
Maximum pulse energy (τ = 10 µs, RF attenuation ≥10 dB): Input 1: ESBI: <1 mWs (= 100 W for 10 µs); ESMI: <10 mWs (= 1 kW for 1 µs); Input 2: <1 mWs (= 100 W for 10 µs).

Level Compression – Pulse spectral density at 1 dB compression (RF attenuation 0 dB, RF preselector on, RF preamplifier off).

Frequency	1 dB Compression for ESBI, ESMI
f <150 kHz	>110 dB µV/MHz
150 kHz to 5 MHz	>86 dB µV/MHz
5 MHz to 30 MHz	>80 dB µV/MHz
30 MHz to 300 MHz	>76 dB µV/MHz
300 MHz to 1 GHz	>75 dB µV/MHz
>1 GHz	>50 dB µV/MHz

Maximum Inherent Noise Indication in CISPR Bands – See Table 1. RF preamplifier off, RF attenuation 0 dB, discrete spuria excepted.

Inherent Noise Indication – All units, maximum sensitivity setting in the frequency range 20 to 200 Hz (bandwidth 10 Hz, video bandwidth 1 Hz, preamplifier off): 45 dBµV.

EMI, Field Strength
ESBI • ESMI

SPECTRAL SENSITIVITY
Resolution Bandwidth 1 MHz, f >30 MHz, Peak-value Indication –

Unit	Preamplifier 0 dB	Preamplifier 10 dB
ESBI	<30 dBµV/MHz	<21 dBµV/MHz
ESMI (<18 GHz)	<32 dBµV/MHz	<23 dBµV/MHz

Level Measurement Error After Internal Calibration (sum error in indication range and in temperature range 15 to 35°C) –
ESBI (f = 9 kHz to 1 GHz): <1.5 dB; up to 5 GHz, 3 dB maximum typical.
ESMI (f = 9 kHz to 1 GHz): <1.5 dB; up to 26.5 GHz, 4 dB maximum typical.

SWEEP RELATED
Sweep Time – See Table 2.

Trigger Modes – Free run, line, video, external.

SCALAR NETWORK ANALYSIS
Tracking-generator Frequencies and Levels – See Table 3.

IF and Image Frequency Rejection –
IF rejection: >100 dB (>110 dB typical).
Applies to all IF frequencies used except:
ESMI, 221.4 MHz: >90 dB (110 dB typical).
Image frequency:
ESBI/ESMI, f + 10.8428 GHz: >80 dB (90 dB typical).
ESBI, f + 442.8 MHz: >100 dB (115 dB typical).
ESMI, f + 442.8 MHz: >85 dB (100 dB typical).
All units, f + 42.8 MHz: >100 dB (115 dB typical).
All units, f + 8.388 MHz: >100 dB (115 dB typical).

Measurement Ranges for Gain and Attenuation –
Measurement Range

Unit	Gain	Attenuation	Frequency Offset
ESBI	110 dB	110 dB	0 to ±1 GHz
ESMI (to 5 GHz)	105 dB	110 dB	0 to ±1 GHz
ESMI with Opt. 01 5 GHz to 18 GHz	105 dB	105 dB	Not provided
18 GHz to 26.5 GHz	105 dB	100 dB	Not provided

Demodulation – AM and FM.
Evaluation (modulation analysis): Measurement of modulation depth and frequency deviation. Auto-monitoring: Built-in loudspeaker and headphones output.

INPUTS AND OUTPUTS
Front Panel of RF Unit –
Input 1: Connector: BNC female, 50 Ω.
DC coupling: 20 Hz to 200 MHz.
AC coupling: 9 kHz to 200 MHz.
VSWR: RF attenuation 0 dB: <2.0.
RF attenuation ≥10 dB: <1.2.
Protection: Fuse, surge arrester.
Input 2 (DC coupling only): Connector:
ESBI: N female, 50 Ω.
ESMI: 3.5 mm SMA female.
VSWR:

Unit	RF atten. 0 dB	RF atten. ≥10 dB	RF atten. RF ≥20 dB
ESBI			
f <1 GHz	<2.0	<1.2	–
f = 1 to 2.7 GHz	<3.0	<1.5	–
f = 2.7 to 4.8 GHz	<3.0	<1.8	–
ESMI			
f <1 GHz	<2.0	<1.2	–
f = 1 to 2.7 GHz	<3.0	<1.5	–
f = 2.7 to 4.8 GHz	<3.0	<1.8	–
f = 4.8 to 26.5 GHz	<3.0 (typical)	–	<2

Selectable preamplifier:
ESBI: 100 Hz to 5 GHz, 10 dB.
ESMI: 100 Hz to 26.5 GHz, 10 dB.

Continued on next page

TABLE 1 – INHERENT NOISE INDICATION

Frequency Range	CISPR Band/ Bandwidth	Unit	Indication (in dBµV) Average	Quasi-peak	Peak
9 kHz to 150 kHz	A/200 Hz	ESBI, ESMI	–7	–5	+4
150 kHz to 5 MHz	B/9 kHz	ESBI, ESMI	0	+3	+11
5 MHz to 30 MHz	B/9 kHz	ESBI, ESMI	–5	–2	+6
30 MHz to 300 MHz	C/120 kHz	ESBI, ESMI	+5	+9	+16
300 MHz to 1 GHz	D/120 kHz	ESBI, ESMI	+8	+12	+19

NOTE: In the frequency range from 20 Hz to 1 MHz, figures for the noise indication are valid in the temperature range 15 to 35°C. Outside this temperature range, the specified values may vary by 10 dB maximum. The guaranteed sensitivity value in the CISPR bands is improved by 9 dB with the preamplifier on.

TABLE 2 – SWEEP

Sweep Time	Span = 0 Hz Step Size	Error	Span >0 Hz (sampling rate: 1/8.9 µs) Step Size	Error
0.2 ms to 10 ms	–	–	1, 2, 4, 8, 10	<2%
20 ms to 2 s	20 ms	10^{-3}	20 ms	10^{-3}
2 s to 20 s	200 ms	10^{-3}	200 ms	10^{-3}
20 s to 1980 s	2 s	10^{-3}	2 s	10^{-3}

TABLE 3 – SCALAR NETWORK ANALYSIS

Unit	Output Frequency Min	Max	Output Level Min	Max	Steps
ESBI	100 Hz	5 GHz	26 dBµV	107 dBµV	0.1 dB
ESMI	100 Hz	5 GHz	32 dBµV	107 dBµV	5 dB

EMI, Field Strength
ESBI • ESMI

Input divider:
ESBI: 0 to 120 dB in steps of 2 dB.
ESMI: 0 to 75 dB in steps of 5 dB.
Calibration output: Connector: BNC female, 50 Ω.
Signal: Unpulsed: 100 MHz, 87 dBµV; Pulsed: Pulse area to CISPR 16-1, Pulse Repetition Frequency: 1 Hz to 1 kHz.
Coding and supply connector: Connector: 12-contact Tuchel female:
Supply voltage: +10 V, –10 V, 100 mA maximum each.

Front Panel of Display Unit –
PHONES: Connector: JK34 jack; Frequency Range: 100 Hz to 15 kHz; EMF (V p-p maximum): 10 V.
Output impedance: 30 Ω.
KEYBOARD: Connector: JK34 jack.

Rear Panel of RF Unit –
IF OUTPUT 21.4 MHz: Connector: BNC female, 50 Ω; VSWR: ≤2.
Gain (referenced to level at input mixer = reference level – RF attenuation) ≤–20 dBm (87 dBµV): +8 dB ±2 dB. >–20 dBm (87 dBµV): 0 dB ±2 dB. Bandwidth (–6 dB): >10 MHz.
10-MHz Reference: Connector; BNC female.
Output level with internal reference (Z_{in} = 50 Ω): +10 dBm +3/–1 dB. Input level with external reference (Z_L >500 Ω): 0 to 5 V.
EXT ALC: Connector: BNC female.
Input voltage: 0 to –1 V.
SWEEP OUTPUT: Connector: BNC female.
Output voltage (Z_L >500 Ω): 0 to +5 V.
START-SWEEP-STOP: Connector; BNC female.
Output: TTL pulse (t = 1.4 µs) occurring upon sweep start or stop.

Rear Panel Display Unit –
IF OUTPUT (narrow); 21.4 MHz: Connector: BNC female, 50 Ω. VSWR: <2.
Level with reference level; –15 dBm ±3 dB.
EXT SWEEP TRIG: Connector: BNC female.
VIDEO OUTPUT: Connector: BNC female.
EXTERNAL MONITOR: Connector: BNC female. Outputs; RED, GREEN, BLUE, COMP VIDEO; V SYNC; H SYNC. Line frequency: 29.5 kHz. Sync pulse: 2 µs.
EXT FLOPPY: Connector: 37-contact Cannon D female.
RS-232C: Connector; 25-contact Cannon D female.
PARALLEL INTERFACE: (Centronics) Connector: 36-contact Amphenol female.
USER PORT: Connector: 25-contact Cannon D female.
PHONES: Connector: JK34 jack. Frequency range (–3 dB): 100 Hz to 15 kHz; EMF: 10 V p-p. Source impedance: 30 Ω.
IEC 625 bus (IEEE 488): Connector: 24-contact Amphenol female. Bus functions: AH1, SH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C1 to C4, C11.

DISPLAY RELATED
Monitor – 9 inch color CRT.

Resolution – 1024 x 512 points.

Display Mode – Full display height or 2 x 1/2 display height (split screen).

Number of Display Memories – 4.

Output to Plotter – HPGL, pinwriter (24-Pin) laser printer.

Plotter Functions – Curve arithmetic (swap, subtract), comparison with tolerance curves, averaging, peak hold.

POWER REQUIREMENTS
Line Voltage – 100, 120, 220, 240 ±10%.

Line Frequency – 45 to 66 Hz.

Power Consumption – 500 VA.

ENVIRONMENTAL CHARACTERISTICS
Temperature –
Operating: 0 to +55°C. Storage: –40 to +70°C.
Relative humidity: 20 to 90% (without condensation).

EMC – To EN 50081-1 and EN 50082-1 (EEC Directive): FCC DOC 20780: Part 15, Subpart 5.

Warmup Period – Operating temperature attained after one hour after cold start at T_{amb} = 0 to 55°C.

PHYSICAL CHARACTERISTICS

	ESAI, ESBI		ESMI	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	435	17.1	435	17.1
Height	413	16.3	457	18.0
Depth	590	23.2	590	23.2
Weight	**kg**	**lb.**	**kg**	**lb.**
Net	64	141.1	68	150

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ESBI
EMI Test Receiver (20 Hz to 5 GHz).
Includes: Power Cord, Manual.

ESMI
EMI Test Receiver (20 Hz to 26.5 GHz).
Includes: Power Cord, Manual.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Service Kit – Order FS-Z1.

Connecting Cable Kit (for servicing, 1 m) – Order FS-Z2.

ES-K1 Software – EMC Compliance Test Software. See page 225 for details.

Adapters –
N-male to BNC-female Adapter. Order 103-0045-00.
N-female to BNC-male Adapter. Order 103-0058-00.
3.5 mm Male-to-Male Adapter. Order 015-0551-00.
3.5 mm Female-to-Female Adapter. Order 015-0550-01.

ADDITIONAL ACCESSORIES
Also see page 438.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI/RFI Solutions

ESHS • ESVS • ESS

Features

- Complies with CISPR 16, VDE 0876, and ANSI C63.2
- Measurements to European Standards 55 011 to 55 022, ETS, FCC, VCCI, and VDE 0871 to 0879

ESHS

- Frequency Range 9 kHz to 30 MHz
- Operation from AC Supply or Internal/External Battery

ESVS

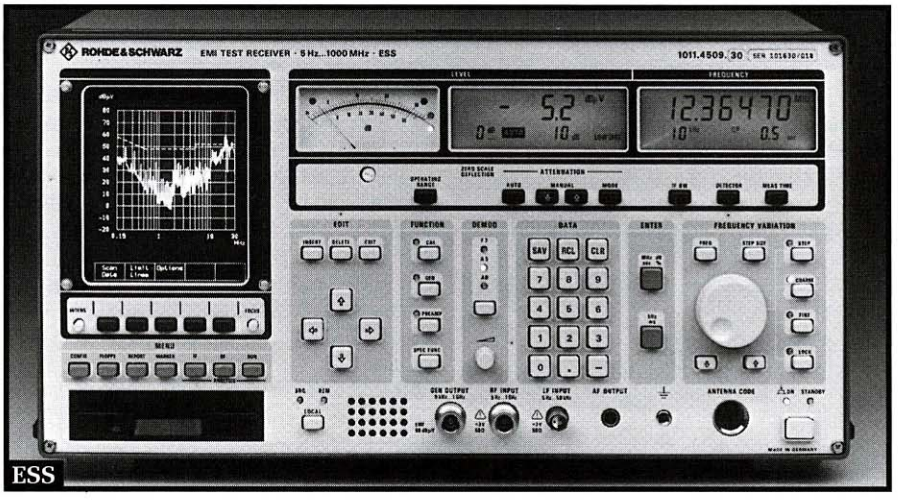
- Frequency Range 20 MHz to 1 GHz
- Operation from AC Supply or Internal/External Battery

ESS

- Frequency Range 5 Hz to 1 GHz
- Resolution Bandwidths from 2 Hz to 1 MHz
- Operation from AC Supply or External Battery
- Measurements to Military Standards MIL-STD-461, DEF STAN 59-41, GAM-EG 13, and VG 95370 and 95673

Applications

- EMI Measurements to All Relevant Commercial and MIL-STD Specifications
- Field-strength Measurements Using Test Antennas



Introduction

The number of measurements required to ensure electromagnetic compatibility is continuously increasing. Thanks to the built-in intelligence of the ESHS/ESVS/ESS EMI Test Receivers, the time required for such measurements is reduced considerably. These test receivers are specialized for measurements to the applicable CISPR, CENELEC, ETSI, FCC, VCCI, and VDE standards. In addition, the ESS provides measurements to the relevant military standards as well – MIL, VG, DEF, and STAN.

The ESHS/ESVS/ESS feature high frequency resolution and accurate level indication in peak average and quasi-peak detection (ESS provides RMS also). The real strength, however, is the automatic measurement of RFI voltage, current, power, and field strength. After a fast pre-scan measurement, it compares the results with prescribed limits, displays the interference spectrum with the limits on the screen, and furnishes a comprehensive test report with all the necessary information. The time-consuming quasi-peak measurement is only carried out in cases where the peak value is close to the relevant limit.

EMI TEST RECEIVER FEATURES

The ESHS 10, ESHS 30, ESVS 10, ESVS 30, and ESS share the same basic design and performance characteristics. The various models provide differing features which provide full EMI measurement performance from 5 Hz to 1 GHz. All models feature an excellent price/performance ratio, compact design, high measurement speed, and great operating convenience. Following are the primary features; features are shared by all instruments unless noted otherwise:

RF Section –

- High pulse loading capacity of calibrated attenuator
- Comprehensive preselection filters
- Switchable preamplifier with wide dynamic range
- Crystal-stabilized, fast synthesizer with high resolution and sweep
- High-level mixer with high oscillator rejection
- IF filters with low delay distortion

Demodulation –

- Parallel detectors for average, peak, and quasi-peak indication (ESS also provides RMS indication)
- 60 dB operating ranges for quasi-peak and average value indication
- Highly linear envelope detector
- AM and A0 demodulators (ESVS and ESS also provide FM demodulation)
- Logarithmic amplifier with more than 70 dB dynamic range
- Automatic overload detection in the mixer stages and in the test channel by permanently activated peak detectors

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI/RFI Solutions

ESHS • ESVS • ESS

Powerful Processor System –

- Macros for automatic and semi-automatic test runs
- 12-Bit A/D converter with short conversion time
- Measurement time selectable between 1 ms and 100 s
- High measurement accuracy as a result of automatic total calibration
- Automatic monitoring of all synthesizer loops and supply voltages during operation
- Nonvolatile storage of 10 complete instrument setups and 22 different transducer factors and limit lines

Optimal Display of Results for Every Application –

- Measurement of voltage, field strength, current, and pulse spectral density with full indication of units
- Indication of level on analog meter and digital readout with 0.1-dB resolution
- Display of interference spectra (RF ANALYSIS) including limit lines on low-emission screen
- IF analysis for visual check of interference spectrum in manual measurement mode (ESHS 30, ESVS 30, ESS)
- Built-in tracking generator for attenuation and gain measurements (ESHS 30, ESVS 30, ESS)

Storage and Listing of Results –

- Built-in 3.5 in. disk drive for storing test results and instrument settings (ESHS 30, ESVS 30, ESS)
- Output of results as lists and diagrams on printer or plotter including limit lines and user-definable labeling

SIMPLE OPERATION

A combination of hardkeys and softkeys ensures simple operation and fast access to the menu functions. All models have the classic test receiver controls on the right of the front panel for manual settings. The left section of the front panel is used to edit data for automatic test runs, tables for limit values and transducer factors (for example, for current and voltage probes and antennas), as well as special functions and the information required for test reports.

OPTIMIZED TEST RUNS

EMI measurements have differing degrees of complexity. The simplest case is measurement of the EMI spectrum on a data line. In the most complicated case, many parameters have to be varied and additional conditions observed to find the maximum spurious emission and then weight it correctly with quasi-peak weighting. The time-consuming quasi-peak measurement is only carried out in cases where the peak value is close to the relevant limit.

These EMI test receivers offer a choice between automatic, semi-automatic, and user-controlled test runs. Scan options are available for prescan measurements, data reduction, and final measurements.

Data reduction is the main criterion for optimizing the test run. It's the link between prescan interface measurement and correct weighting with test-parameter variation (final measurement) to reduce measurement time. Scan options are also available to take account of the test configuration: for instance, measuring RFI voltage with LISNs, RFI power with an absorbing clamp, and RFI and field strength with antennas.

CHARACTERISTICS

	ESHS	ESVS	ESS
Frequency Related			
Frequency Range	9 kHz to 30 MHz	20 MHz to 1 GHz	5 Hz to 1 GHz, subdivided into following ranges:
Range I	–	–	5 Hz to 50 kHz (tunable down to 1 Hz)
Range II	–	–	9 kHz to 30 MHz
Range III	–	–	20 MHz to 1 GHz (automatic range selection, depending upon IF bandwidth and RF input (balanced/unbalanced))
Frequency Setting			
With tuning knob	In 10 Hz, 10 kHz, or any step size (switch selectable)	In 100 Hz, 100 kHz steps or any step size selectable	Fine or coarse increments or freely selectable step size:
Range I	–	–	Fine, 0.1 Hz; Coarse, 100 Hz
Range II	–	–	Fine, 10 Hz; Coarse, 10 kHz
Range III	–	–	Fine, 100 Hz; Coarse, 100 kHz
Numerical	Via keyboard entry	Via keyboard entry	Via keyboard entry
In steps	Any selectable size	Any selectable size	Any selectable size
Automatic scanning	For RF analysis	For RF analysis	For RF analysis

EMI/RFI Solutions

ESHS • ESVS • ESS

	ESHS	ESVS	ESS
Frequency Related (Continued)			
Frequency Display	7-digit LCD	8-digit LCD	8-digit LCD
Resolution	10 Hz	100 Hz	–
Range I	–	–	0.1 Hz
Range II	–	–	10 Hz
Range III	–	–	100 Hz
Setting Error	$<3 \times 10^{-6} + 30$ Hz	$<3 \times 10^{-6}$	$<3 \times 10^{-6}$
RF Input			
Connector	N connector, female	N connector, female	–
5 Hz to 1 GHz, unbalanced	–	–	N connector, female
5 Hz to 50 kHz, balanced	–	–	Twinax connector, female
Impedance	50 Ω	50 Ω	50 Ω
VSWR			
≥10 dB RF attenuation	<1.2	<1.2	<1.2
0 dB RF attenuation	<2	<2	<2
Oscillator Reradiation at RF Input (0 dB RF attenuation)			
Without preamplifier	<20 dBµV	<20 dBµV	<20 dBµV
With preamplifier	<10 dBµV	<10 dBµV	<10 dBµV
Preamplifier	Switchable between input filter and 1st mixer	Switchable between preselector and 1st mixer	Switchable between preselector and 1st mixer
Gain	10 dB	10 dB	10 dB
Preselector	5 bandpass filters: 9 kHz to <150 kHz 150 kHz to <4.05 MHz 4.05 MHz to <12.8 MHz 12.8 MHz to <21.55 MHz 21.55 MHz to 30 MHz	1 fixed-tuned filter: 20 to <51.3 MHz 5 tracking filters: 51.3 to <125.3 MHz 125.3 to <273.3 MHz 273.3 to <495.3 MHz 495.3 to <717.3 MHz 717.3 to 1 GHz	–
Range I	–	–	1 fixed bandpass filter: 5 Hz to 50 kHz
Range II	–	–	5 fixed bandpass filters: 9 kHz to <150 kHz 150 kHz to <4.05 MHz 4.05 MHz to <12.8 MHz 12.8 MHz to <21.55 MHz 21.55 MHz to 30 MHz
Range III	–	–	1 fixed bandpass filter: 20 MHz to <51.3 MHz 5 tracking bandpass filters: 51.3 MHz to <125.3 MHz 125.3 MHz to <273.3 MHz 273.3 MHz to <495.3 MHz 495.3 MHz to <717.3 MHz 717.3 MHz to 1 GHz

EMI/RFI Solutions
ESHS • ESVS • ESS

RF Input (continued)	ESHS	ESVS	ESS
Maximum Input Level (with and without preamplifier)			
RF attenuation 0 dB (AC-coupled)			
DC voltage	7 V	50 V	7 V
Sinewave AC voltage	130 dBµV	130 dBµV	130 dBµV
Pulse spectral density	96 dBµV/MHz	97 dBµV/MHz (100 V for 0.5 ns)	97 dBµV/MHz
RF attenuation ≥10 dB (DC-coupled)			
DC voltage	7 V (= 1 W)	50 V	–
Sinewave AC voltage	137 dBµV	137 dBµV (corresponds to 1 W)	–
Maximum pulse voltage (10 µs)	700 V	150 V	–
Maximum pulse energy	100 mWs (10 µs)	10 mWs (20 µs)	–
Range I and II			
DC voltage	–	–	7 V (corresponds to 1 W)
Sinewave AC voltage	–	–	137 dBµV
Maximum pulse voltage	–	–	700 V
Maximum pulse energy (10 µs)	–	–	100 mWs
Range III			
DC voltage	–	–	7 V (corresponds to 1 W)
Sinewave AC voltage	–	–	137 dBµV
Maximum pulse voltage	–	–	1500 V
Maximum pulse energy (10 µs)	–	–	100 mWs
Interference Rejection, Non-linearities			
Image frequency rejection			
1st IF	>90 dB, 100 dB typical	>90 dB, 100 dB typical	>90 dB, 100 dB typical
2nd IF	>75 dB	>90 dB, 100 dB typical	
IF rejection	>90 dB, 100 dB typical	>90 dB, 100 dB typical	>90 dB, 100 dB typical

IF Bandwidths	Nominal Bandwidth	–3 dB (±20%)	–6 dB	Shape Factor $BW_{6\ dB}/BW_{50\ dB}$ (Selectable in Range)
ESHS	200 Hz*1	140 Hz	200 Hz +20/–30 Hz	1:8 typical
	10 kHz*2	7 kHz	9.5 kHz ±0.5 kHz	1:3.5 typical
ESVS	10 kHz	7 kHz	9.5 kHz ±0.5 kHz	1:4 typical
	120 kHz	90 kHz	120 kHz ±10%	1:5.5 typical
ESS	2 Hz	1.4 Hz	2 Hz	1:2.5 (I)
	5 Hz	3.5 Hz	5 Hz	1:2.5 (I)
	10 Hz	7 Hz	10 Hz	1:2.5 (I)
	20 Hz	14 Hz	20 Hz	1:2.5 (I)
	50 Hz	35 Hz	50 Hz	1:2.5 (I+II)
	100 Hz	70 Hz	100 Hz	1:2.5 (I+II)
	200 Hz	140 Hz	200 Hz	1:2.5 n(I+II)
	500 Hz	350 Hz	500 Hz	1:2.5 (I+II+III)
	1 kHz	700 Hz	1 kHz	1:2.5 (I+II+III)
	10 kHz*3	7 kHz	9.5 kHz ±10.5 kHz	1:4 (II+III)
	100 kHz	70 kHz	100 kHz	1:5 (II+III)
	120 kHz	90 kHz	120 kHz	1:5 (II+III)
	1 MHz	700 kHz	1 MHz	1:5 (II+III)

**1 Meets tolerances to CISPR 16.*

**2 Meets tolerances to CISPR 16 (minimum 8 kHz, 10 kHz maximum) and complies with MIL tolerances (10 kHz ±10%).*

**3 Complies with tolerances to CISPR and MIL tolerances of 10 kHz ±10%.*

EMI/RFI Solutions

ESHS • ESVS • ESS

Noise Indication	Preamplifier off	Preamplifier on
ESHS		
Average value, BW 200 Hz		
f_{in} 9 to 50 kHz	<–24 to <–30 dBµV	<–30 to <–36 dBµV
f_{in} >50 kHz	<–30 dBµV, –35 dBµV typical	<–36 dBµV, –41 dBµV typical
Average value, BW 10 kHz		
f_{in} >50 kHz	<–14 dBµV, –17 dBµV typical	<–20 dBµV, –25 dBµV typical
Peak value (typical increase against average value)	+11 dB	+11 dB
Quasi-peak		
Band A		
9 to 50 kHz	–24 to –30 dBµV typical	–30 to –36 dBµV typical
50 to 150 kHz	–32 dBµV typical	–38 dBµV typical
Band B ≥150 kHz	–13 dBµV typical	–19 dBµV typical
PK/MHz (BW 10 kHz)	34 dBµV/MHz typical	28 dBµV/MHz typical
ESVS		
Average value		
BW 10 kHz	<–12 dBµV, –15 dBµV typical	<–16 dBµV, –21 dBµV typical
BW 120 kHz	<–1 dBµV, –4 dBµV typical	<–5 dBµV, –10 dBµV typical
Peak value		
BW 10 kHz	–4 dBµV typical	–9 dBµV typical
BW 120 kHz	+7 dBµV typical	+1 dBµV typical
Quasi-peak Band C/D	+2 dBµV typical	–4 dBµV typical
PK/MHz (spectral density measurement, BW 120 kHz)	25 dBµV/MHz typical	21 dBµV/MHz typical
ESS		
Average value, Range I		
BW 2 kHz, f_{in} = 5 to 30 Hz	<–38 to –48 dBµV typical	<–38 to –52 dBµV typical
BW 10 kHz, f_{in} = >30 Hz	<–40 dBµV, –44 dBµV typical	<–41 dBµV, –48 dBµV typical
Average value, Range II		
BW 200 kHz, f_{in} = 9 to 50 Hz	<–24 to –30 dBµV typical	<–30 to –36 dBµV typical
BW 200 kHz, f_{in} = >50 Hz	<–30 dBµV, –35 dBµV typical	<–36 dBµV, –41 dBµV typical
Average value, Range III		
BW 120 kHz	<1 dBµV, –6 dBµV typical	<–5 dBµV, –10 dBµV typical
RMS value (typical increase vs. average reading)	+1 dB	+1 dB
Peak (PK) value (increase vs. average reading)	+11 dB	+11 dB
ESS		
Quasi-peak		
Band A		
9 to 50 kHz	–27 dBµV	–30 dBµV
50 to 150 kHz	–32 dBµV	–38 dBµV
Band B	–13 dBµV	–19 dBµV
Band C/D	+2 dBµV	–4 dBµV
PK/MHz		
Range II, BW 10 kHz	34 dBµV/MHz	28 dBµV/MHz
Range III, BW 1 MHz	16 dBµV/MHz	12 dBµV/MHz

EMI/RFI Solutions

ESHS • ESVS • ESS

Voltage Measurement Range	Preamplifier off	Preamplifier on
ESHS (f >50 kHz)		
Lower limit (additional error caused by inherent noise <1 dB)		
Average indication (AV)		
BW_{IF} 10 kHz	–6 dBµV, –10 dBµV typical	<–12 dBµV, –18 dBµV typical
BW_{IF} 200 Hz	–26 dBµV, –31 dBµV typical	<–32 dBµV, –37 dBµV typical
Peak indication (PK)		
BW_{IF} 10 kHz	–10 dBµV typical	+4 dBµV typical
BW_{IF} 200 kHz	–8 dBµV typical	–14 dBµV typical
Quasi-peak indication (QP)		
CISPR band A (25 Hz pulse repetition frequency)	–30 dBµV typical	–36 dBµV typical
CISPR band B (100 Hz pulse repetition frequency)	–11 dBµV typical	–17 dBµV typical
Spectral density (PK/MHz)	50 dBµV/MHz typical	44 dBµV/MHz typical
Upper limit (AV, PK, QP)	137 dBµV (RF attenuation ≥10 dB)	137 dBµV (RF attenuation ≥10 dB)
Inherent spurious response	<–10 dBµV (equivalent input voltage)	<–10 dBµV (equivalent input voltage)
ESVS		
Lower limit (additional error caused by inherent noise <1 dB)		
Average indication (AV)		
BW 10 kHz	<–8 dBµV, –11 dBµV typical	<–12 dBµV, –17 dBµV typical
BW 120 kHz	<+3 dBµV, 0 dBµV typical	<–1 dBµV, –6 dBµV typical
Peak indication (PK)		
BW 10 kHz	+12 dBµV typical	+7 dBµV typical
BW 120 kHz	+23 dBµV typical	+17 dBµV typical
Quasi-peak indication (QP)		
CISPR band C/D (100 Hz pulse repetition frequency)	<+10 dBµV, +6 dBµV typical	<+4 dBµV, 0 dBµV typical
Upper limit (AV, PK, QP)	137 dBµV (RF attenuation ≥10 dB)	137 dBµV (RF attenuation ≥10 dB)
Inherent spurious response	<0 dBµV (equivalent input voltage)	<0 dBµV (equivalent input voltage)
ESS		
Lower limit (additional error caused by inherent noise ≤1 dB)		
Average (AV)	4 dB above noise indication	4 dB above noise indication
RMS	5 dB above noise indication	5 dB above noise indication
Peak (PK)	15 dB above noise indication	15 dB above noise indication
Quasi-peak (QP) (25/100 Hz pulse repetition frequency)	3 dB above noise indication	3 dB above noise indication
Upper limit (AV, RMS, PK, QP)	137 dBµV (RF attenuation ≥10 dB)	137 dBµV (RF attenuation ≥10 dB)
Inherent spurious response (equivalent input voltage)		
5 Hz to 30 MHz	<–10 dBµV	<–10 dBµV
30 MHz to 1 GHz	<0 dBµV	<0 dBµV

Characteristics *(continued)*

DISPLAY RELATED

Level Display –
Digital, Digits: 3 1/2. Resolution: 0.1 dB. Units: dBµV, dBµA, dBm, dBµV/m, dBµA/m, dBµV/MHz, dBµA/MHz, dBµV/m/MHz, dBµA/m/MHz, dBpW, dBpT. Analog: Moving-coil meter in operating range of IF detector with additional digital display of lower range limit. Operating ranges, 30, 60 dB.

Screen (ESHS 30, ESVS 30, ESS) –
(RF analysis), Display: 5-inch CRT with digital video memory. Resolution: 1024 x 1024 pixels. Display range, X axis (frequency): Freely selectable, linear or logarithmic (ESS, maximum 1 GHz). Y-axis (level): 10 to 200 dB, adjustable. Marker Functions: Marker, delta marker, marker set to maximum, receiver frequency set to marker frequency.

Display Modes (detectors) – Average (AV), RMS (ESS only), peak (PK), spectral density measurement (PK/MHz), quasi-peak (QP). Averaging, Hold, and Measuring Times: 1 ms to 100 s (1-2-5 steps).

Measurement Error –
(ESHS) (AV for S/N >16 dB), Digital Display: <1 dB. Analog Display: <2 dB typical. Level Calibration: Harmonics generator.

(ESVS) (AV for S/N >16 dB), Digital Display: 0 to +55°C: ≤1 dB. –10 to 0°C: <1.5 dB. Analog Display: <2 dB typical.

(ESS) (AV for S/N >16 dB), Digital display: Range I and II: <1 dB. Range III: 0 to +55°C: <1 dB. –10 to 0°C: ≤1.5 dB. Analog Display: <2 dB typical. Level Calibration: Sinewave and harmonics generator.

Demodulation Modes –
(ESHS), A0 (zero beat); A3 (for A3E emissions).

(ESVS, ESS), A0 (zero beat); A3 (for A3E emissions); F3 (for F3E).

IF Analysis (ESHS 30, ESVS 30, ESS Range II and III) – Display Range: 10 kHz to 2 MHz (in 1-2-5 steps). Input Attenuation: 0 and 20 dB, selectable.

Nominal bandwidth	Resolution –3 dB (±20%)	Shape Factor BW6 dB:BW60 dB
10 kHz	10 kHz	1:4
3 kHz	3 kHz	1:6
1 kHz	1 kHz	1:9

Sweep Time: 50 ms to 10 s (1-2-5 steps). Level Display Range: 80 dB. Level Display (ESS only): Normal and normal + max hold. Marker Functions: Marker, delta marker, marker set to maximum, marker set to center frequency (receiver frequency).

Date, Time of Day – Internal clock, permanently operated from internal battery.

INPUT/OUTPUT

Floppy Disk Drive (ESHS 30, ESVS 30, ESS) –
3.5 inch, 1.44 MB formatted. Formatting: MS-DOS compatible. Data format HP-GL or binary.

Remote Control –
IEC 625-2 (IEEE 488). Connector: 24-contact Amphenol connector. Interface Functions: AH1, L4, SH1, T6, SR1, PP1, RL1, DC1, DT1, C1, C2, C3, C11. Plotter language: HP-GL (via IEC/IEEE bus interface).

Front-panel Outputs –
Supply and Coding Connector for Antennas, etc.: 12-contact Tuchel connector.

AF Output, Connector: JK34 jack. Impedance: 10 Ω. EMF: Adjustable up to 1.5 V.

Generator output 9 kHz to 1 GHz; (ESHS 30, ESS), Connector: N female. Impedance: 50 Ω. EMF: 96 dBµV ±1 dB.

Rear-panel Outputs –
IF 74.7 MHz (ESHS 10, ESVS 10), Connector: BNC female. Impedance: 50 Ω. Gain Referred to RF Input (RF attenuation 0 dB): 10 dB without preamplifier, 20 dB with preamplifier. Bandwidth (–3 dB): 2 MHz or bandwidth of preselector.

IF 10.7 MHz (ESVS, ESS), Connector: BNC female. Impedance: 50 Ω. EMF in Range of Analog Level Display for Unmodulated Sinewave Signal: Operating range 30 dB, 1 to 30 mV; Operating Range 60 dB, 1 mV to 1 V. Bandwidth (–3 dB): IF bandwidth.

IF 80 kHz (ESHS), Connector: BNC female. Impedance: 50 Ω. EMF in Range of Analog Level Display for Unmodulated Sinewave Signal: Operating range 30 dB, 1 to 30 mV; Operating range 60 dB, 1 mV to 1 V. Bandwidth: IF bandwidth.

Video Output (envelope detector), Connector: BNC female. EMF in Range of Analog Level Display: Operating range 30 dB, 4 to 126 mV; Operating range 60 dB, 4 mV to 4 V.

User Interface, Connector: 25-contact Cannon connector. Function: Six control lines for an external device (e.g., artificial mains network), display voltage with and without meter simulation, input for external triggering, RS-232C interface for firmware updating.

Printer Connection, Connector: 15-contact Cannon connector. Function: Parallel interface.

Keyboard connector, Connector: 5-contact DIN connector. Function: For MF2 keyboard.

Rear-panel Inputs –
External Reference Frequency, Connector: BNC female. Required level: EMF ≥1 V from 50 Ω. Frequency: 5/10 MHz.

External battery, Connector: 3-contact connector. Required voltage: 11 to 33 V.

EMI/RFI Solutions

ESHS • ESVS • ESS

POWER REQUIREMENTS

AC Operation –
Line Voltage: 100 V, 120 V, 220 V, 240 V ±10% (ESS, 230 V +6%/–10%). Line Frequency: 47 to 440 Hz. Power Consumption: ESHS 10, 50 VA; ESVS 10, 60 VA; ESHS 30, 80 VA; ESVS 30, 90 VA; ESS, 110 VA.

DC Operation –
Internal Battery (ESHS 10, ESVS 10): 12 V, 10 AH. Operating Time: ESHS 10: approximately 4 hours; ESVS 10: approximately 2.5 hours.

External battery –
Voltage Range: 11 to 33 V. Current Drain 24/12 V: ESHS 10, 1.2 A/2.3A; ESVS 10, 1.9 A/3.3A; ESHS 30, 2.1 A/3.9 A; ESVS 30, 2.6 A/4.8 A; ESS, 3A/5.5A.

GENERAL SPECIFICATIONS

Environmental Characteristics –
Rated Temperature Range: –10 to +55°C (without condensation). Temperature Range for floppy Disk Drive: +5 to +50°C. Storage Temperature Range: –25 to +70°C. Mechanical Resistance: Shock-tested to MIL-STD-810 D (shock spectrum 40g), Vibration-tested to MIL-T-28800 D, Class 5; complies with IEC Publication 68-2-6. RFI Suppression: Complies with VDE 0876, Part 1a, Regulation 527/1979 and MIL-STD-461 B (CE03 and RE02).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	236	9.3
Width	435	17.1
Depth		
ESHS 10	363	14.3
ESHS 30	463	18.2
ESS	572	22.5
Weight	**kg**	**lb.**
ESHS 10 without battery	18	39.7
ESVS 10 without battery	20.4	45
ESHS 10 with battery	21	46.3
ESVS 10 with battery	23.7	52.2
ESHS 30	28.6	63.1
ESVS 30	26.4	58.2
ESS	32.1	70.8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ESHS 10
EMI Test Receiver.
Includes: Power Cord, Manual.

ESHS 30
EMI Test Receiver.
Includes: Power Cord, Manual.

ESVS 10
EMI Test Receiver.
Includes: Power Cord, Manual.

ESVS 30
EMI Test Receiver.
Includes: Power Cord, Manual.

Opt. 01/ESVS-B1 – Pulse Power Attenuator. Maximum pulse voltage 1500 V.

ESS TEST RECEIVER
EMI Test Receiver.
Includes: Power Cable, Connector for External Battery, N-BNC Adapter, Sun Shield for Screen (ESS only), Manual.

Opt. 01/ESS-B1 –
OCXO Reference Oscillator. 1 x 10^{-7} setting error, 1 x 10^{-9}/day aging error and 1 x 10^{-9}/°C temperature drift.

MEASUREMENT SERVICE OPTIONS
ESHS10:
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES
Also see page 438.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI/Radio Monitoring Solutions

ESVB • ESVD • ESVN • ESN

Features

ESVB

- Frequency Range 20 MHz to 1 GHz (2.05 GHz with Option 02)

ESVD

- Frequency Range 20 MHz to 1 GHz (2.05 GHz with Option 02)
- Frequency Accuracy to GSM Recommendations
- In-phase and Quadrature Output for Evaluating Any Modulated Signal

ESVN

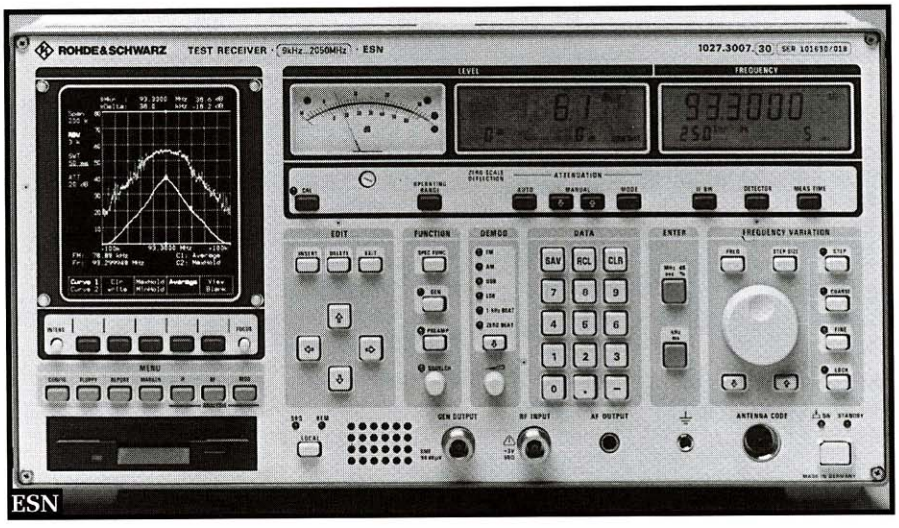
- Frequency Range 20 MHz to 1 GHz
- Remote Control via IEEE 488 Interface
- Operation from AC Supply or Internal/External Battery

ESN

- Frequency Range 9 kHz to 1 GHz (2.05 GHz with Option 01)
- Remote Control via IEEE 488 Interface
- Operation from AC Supply or External Battery

Applications

- Field-strength Measurements Using Test Antennas
- Radio Monitoring to CCIR
- Coverage Measurements
- Selective Voltage Measurements in Labs and Test Shops
- Radio Interference Measurements to EN 55011 to 55022, ETS, FCC and ANSI C63.4, VCCI, and VDE 0871 to 0879
- Digital Audio Broadcasting Networks (ESVB)
- Mobile Radio Networks – GSM, PCN (ESVD)



Introduction

The ESVB/ESVD/ESVN/ESN Test Receivers are ideal instruments for all applications in the fields of radio monitoring and radio network planning, civil RFI measurements to all relevant standards, as well as for selective voltage and two-port measurements in manual and automatic mode. ESVB/ESVD/ESVN/ESN are used to measure and demodulate both amplitude-modulated (DSB, SSB pulse) and frequency-modulated signals, as well as narrowband and broadband interference in the range from 20 MHz to 1 GHz (ESVN), 9 kHz to 2.050 MHz (ESN), and 20 MHz to 2.05 GHz (ESVB/ESVD Option 02).

Manual operation or automatic mode, with spectrum display on screen and reports of results on printer or plotter, make these Test Receivers extremely versatile for many applications.

TEST RECEIVER FEATURES

The ESVB/ESVD/ESVN/ESN Test Receivers combine three different types of test receivers in one:

- A compact, manually tuned and battery-operated test receiver
- A test receiver which automatically performs measurements and reports the results
- A system-compatible test receiver

Following are the primary features which are shared by both instruments unless noted otherwise:

RF UNIT

- High measurement accuracy: error <1 dB, <0.5 dB typical
- Refined preselection
- Switchable preamplifier with wide dynamic range
- Crystal-stabilized synthesizer (ESN): sweep mode for fast frequency scans, frequency resolution down to 10 and 100 Hz
- Wide dynamic range: noise figure typically 7 dB with preamplifier, 12 dB without preamplifier, third-order intercept point typically 20 dBm (without preamplifier)
- Tracking generator for attenuation and gain measurements with ESVN 30 and ESN (9 kHz to 1 GHz)
- High-level mixer ensuring high suppression of 1st LO
- IF analysis with resolution bandwidth of 1, 3, and 10 kHz; span 0.01 to 10 MHz; runs in parallel with level measurements

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI/Radio Monitoring Solutions

ESVB • ESVD • ESVN • ESN

DEMODULATION

- High-linearity envelope detector with dynamic range of more than 70 dB
- Peak, average, RMS, and quasi-peak detectors
- Automatic overload detection in mixer stages and in test channel by permanently activated peak detectors
- Logarithmic amplifier with dynamic range of more than 70 dB
- Frequency and frequency-offset measurements with built-in frequency counter
- Demodulators for measuring modulation depth and frequency and phase deviation
- Demodulator circuits for FM, AM, SSB (LSB and USB), zero beat, and 1-kHz beat
- Built-in loudspeakers and headphones connector; demodulation using signal processors
- Separate signal channel with 5 MHz bandwidth and demodulator for TV signals with switchover to all common TV standards

POWERFUL PROCESSOR SYSTEM

- Macros for automatic test runs
- Test runs over up to 400 freely selectable channels with programmable thresholds
- Automatic level calibration and consideration of frequency-dependent transducer factors (e.g., of antennas)
- Non-volatile storage of 10 complete instrument setups, 22 different antenna factors and limit lines
- Built-in 3.5 in. floppy disk drive
- Output of results as lists and diagrams on plotter or printer including limit lines and user-defined labeling
- 12-Bit A/D converter with short conversion time
- Measurement time adjustable between 1 ms and 100 s, 50 µs for overview measurements
- 16-Bit processor; flash EPROM allowing convenient and fast firmware updating
- Automatic calibration at a keystroke with the aid of an internal high-precision generator
- Automatic monitoring of all synthesizer loop and supply voltages during operation

OPTIMAL DISPLAY OF RESULTS FOR EVERY APPLICATION

- Measurement of voltage, field-strength, and current with full indication of units
- Level indication on analog meter and digital display with 0.1 dB resolution
- Display of modulation depth, deviation, and frequency or frequency offset with very high resolution
- Display of frequency spectra (RF ANALYSIS) including limit values
- IF analysis with spans of up to 10 MHz
- Connector for TV monitor to identify TV programs

MANUAL MODE

These test receivers perform measurements at a fixed frequency with the desired bandwidth, attenuation, measurement time, and display mode. Level measurement, modulation, and deviation measurement, as well as frequency and frequency offset measurement, are carried out simultaneously.

While measurements are being performed, the IF analysis function allows the spectrum about the receive frequency to be analyzed. Measurement of level, modulation, or frequency, as well as signal assessment using the built-in loudspeaker, are made at the center frequency of the extended spectrum with the settings selected. Two test curves can be displayed simultaneously on the screen, the display mode for the two curves being selectable independently of one another.

Max Hold, Max/Min, and Average display modes allow fast identification and measurement of useful and interference signals in a signal spectrum. Marker functions are provided for fast evaluation and measurement of the identified signals in the receive channel.

AUTOMATIC MODE

The receive frequency range is scanned and the result displayed as a spectrum on the screen. The measurement parameters such as start frequency, stop frequency, IF bandwidth, measurement time, attenuation, and display mode can be freely selected.

Single-shot or repetitive scanning can be selected. Two test traces can be displayed at a time. For comparison measurements, waveforms can also be loaded from a floppy disk.

THREE OPERATING MODES FOR FREQUENCY SCANNING

Overview Mode: Frequency scanning over the desired frequency range is at maximum speed and with fixed attenuation.

Scan Mode: Frequency scanning is quasi-continuous with selectable step size and measurement time as well as automatic attenuation setting.

Channel Mode: Frequency scanning over a defined data set with up to 400 frequencies.

DOCUMENTATION OF RESULTS

The results, along with all relevant information, can be output in graphical form or as lists on a plotter or printer. In addition, data can be stored on a floppy disk along with the complete receiver setup. Information can be entered via a line editor or, more conveniently, via an optional keyboard. Date, time, and receiver settings are automatically recorded.

USE IN COMPUTER-CONTROLLED SYSTEMS

Full use of the high measurement rate of these test receivers is possible only in the remote mode using a high-speed controller. In the determination of field-strength profiles, the receivers furnish 5,000 measured values per second after being triggered by a positioning system or a time base. The field strength can be determined at different frequencies with a particular frequency band at a rate of 2.5 ms per measured value. In cellular radio networks, it is thus possible to measure the field strength of several base stations according to Lee's statistical method using a single receiver at the normal speed of the test vehicle.

For radio monitoring, up to 10,000 frequencies can be stored in the receivers and scanned at high speed with range-related receiver settings. The results are then output to the process controller.

EMI/Radio Monitoring Solutions

ESVB • ESVD • ESVN • ESN

Characteristics

FREQUENCY RELATED

Frequency Range –

	ESVB/ESVD/ESVN	ESN
Range I	–	9 kHz to 30 MHz
Range II	20 MHz to 1 GHz	30 MHz to 1 GHz
Range III	1 GHz to 2.050 GHz (ESVB/ESVD)	1 GHz to 2.050 GHz (with Opt. 01)

Frequency Setting –
With tuning knob: Fine, coarse or any step size selectable. Numerical: Via keyboard entry. Step size: Any selectable size. Automatic scanning: For RF analysis.

Frequency Display – 8-digit LCD.

Resolution – Range I: 10 Hz. Range II and III: 100 Hz.

Frequency Error – ESVN: <3 x 10^{-6}. ESN and ESVN with Option 01 (after 30 minutes warm-up): <1 x 10^{-7}.

Temperature Drift – <1 x 10^{-9}/°C.

Aging – <1 x 10^{-7}/year.

RF INPUT

Connector – N connector, female.

Impedance – 50 Ω.

RF Attenuator – 0 to 120 dB, switchable in 10 dB steps.

VSWR –
9 kHz to 1 GHz – 10 dB RF attenuation: <1.2. 0 dB RF attenuation: <2.

1 GHz to 2.050 GHz – 10 dB RF attenuation: <1.35. 0 dB RF attenuation: <2.

Input Filters – Range I: Five fixed-frequency bandpass filter. Range II: One fixed-frequency and five tracking bandpass filters. Range III: Four fixed-frequency bandpass filters.

Preamplifier – Can be connected between input filter and 1st mixer. Gain: 10 dB.

TABLE 1

ESVB/ESVD Nominal Bandwidth	–3 dB (±10%)	–6 dB (±10%)	Shape Factor $BW_{6\ dB}/BW_{60\ dB}$
10 kHz	7 kHz	9.5 kHz	1:4 typ.
120 kHz	90 kHz	120 kHz	1:5 typ.
300 kHz	300 kHz	400 kHz	1:6 typ.
1 MHz	800 kHz	1 MHz	1:4 typ. (ESVD)
1.5 MHz	1.5 MHz	1.8 MHz	1:2.7 typ. (ESVB)

TABLE 2

ESVB/ESVD Noise Indication	Preamplifier off	Preamplifier on
20 to 1000 MHz		
Average value, BW – 10 kHz	< –12 dBµV, typ. –16 dBµV	< –16 dBµV, typ. –20 dBµV
BW – 120 kHz	typ. –5 dBµV	typ. –9 dBµV
BW – 300 kHz	typ. 0 dBµV	typ. –4 dBµV
BW – 1 MHz	typ. 4 dBµV (ESVD)	typ. 0 dBµV (ESVD)
BW – 1.5 MHz	typ. 7 dBµV (ESVB)	typ. 3 dBµV (ESVB)
1000 to 2050 MHz		
Average value, BW – 10 kHz	< –10 dBµV, typ. –15 dBµV	< –16 dBµV, typ. –20 dBµV
BW – 120 kHz	typ. –3 dBµV	typ. –9 dBµV
BW – 300 kHz	typ. 2 dBµV	typ. –4 dBµV
BW – 1 MHz	typ. 6 dBµV (ESVD)	typ. 0 dBµV (ESVD)
BW – 1.5 MHz	typ. 9 dBµV (ESVB)	typ. 3 dBµV (ESVB)

TABLE 3

ESN/ESVN Nominal Bandwidth	–3 dB (±20%)	–6 dB	Shape Factor $BW_{6\ dB}/BW_{50\ dB}$
1 kHz	1 kHz	1.2 kHz ±20%	1:2.8
3 kHz	3 kHz	3.15 kHz ±10%	1:1.8
9 kHz*1	7 kHz	9.5 kHz ±20%	1:2.2
15 kHz	15 kHz	17 kHz ±10%	1:1.8
120 kHz*1	90 kHz	120 kHz ±20%	1:5
250 kHz	250 kHz	330 kHz ±10%	1:3.7

*1 *Meets tolerances to CISPR 16.*

TABLE 4

ESN/ESVN Noise Indication	Preamplifier off	Preamplifier on
Average value, BW 1 kHz		
Range I (f_{in} >50 kHz)	<–22 dBµV, –27 dBµV typical	<–28 dBµV, –33 dBµV typical
Range II	<–18 dBµV, –23 dBµV typical	<–22 dBµV, –28 dBµV typical
Range III	<–16 dBµV, –22 dBµV typical	<–22 dBµV, –28 dBµV typical

EMI/Radio Monitoring Solutions

ESVB • ESVD • ESVN • ESN

Maximum Input Level (with and without preamplifier) –
RF attenuation 0 dB (AC-coupled); DC Voltage: 50 V. Sinewave AC Voltage: 130 dBµV. Spectral Pulse Density: 97 dBµV/MHz.

RF Attenuation >0 dB (DC-coupled); DC Voltage: 7 V (corresponds to 1 W). Sinewave AC Voltage: 137 dBµV. Maximum Pulse Voltage: Range 1, 700 V; Range II and III, 150 V. Maximum Pulse Energy: Range 1, 100 mWs; Range II and III, 1 mWs.

RF Shielding – Voltage Indication at a Field Strength of 10 V/m with 0-dB RF attenuation ($f \neq f_{in}$): <0 dBµV. Additional Error in CISPR Indication Range (10 V/m): <1 dB. Interference: Complies with tolerances to EN50081-1. Interference Immunity: Complies with tolerances to EN50082-1.

IF Bandwidths – ESVB/ESVD: See Table 1, ESVN/ESN: See Table 3.

Noise Indication – ESVB/ESVD: See Table 2, ESN/ESVN: See Table 4.
RMS Value (noise indication average value): +1 dB typical.
Peak (PK) Value (noise indication average value): +12 dB typical.

Voltage Measurement Range –
Lower Limit (additional error caused by inherent noise <1 dB); Average Value (AV): 4 dB above noise indication. RMS Value (RMS): 5 dB above noise indication. Peak Value (PK): 15 dB above noise indication. Quasi-peak (QP) (100 Hz pulse frequency): 3 dB above noise indication.

Upper Limit (AV, RMS, PK, QP): 137 dBµV (RF attenuation >0 dB).

Inherent Spurious Response (equivalent input voltage); Range I: <–10 dBµV. Range II and III: <0 dBµV.

DISPLAY RELATED
Level Display –
Digital; Digits: 3. Resolution: 0.1 dB. Units: dBµV, dBµA, dBm, dBµV/m, dBµA/m, dBpW.

Analog: Moving-coil meter in operating range of IF detector with additional digital display of lower range limit.

Operating ranges: 30, 60 dB.

Screen –
Display: 5 inch CRT with digital memory.

Resolution: 1024 x 1024 pixels.

Display range; X-axis (frequency): Freely selectable, linear or logarithmic. Y-axis (level): 10 to 200 dB, adjustable in 10 dB steps.

Test Curves: Maximum 2 traces. Display Modes: Clr/Write, Max Hold, View.

Frequency Scan Modes; Overview: Scan with fixed attenuation and step size at maximum speed. Scan: Scan with automatic attenuation setting and selectable step size. Channel: Scan at up to 400 predefinable frequency values.

Marker: 2 markers with digital display of frequency and level. Marker Functions: Normal marker, delta marker, marker-to-peak, marker-to-receiver frequency.

Indication Modes – Average value (AV), RMS value (RMS), peak value (PK), quasi-peak value (QP, f_{in} >150 kHz). Measurement time: 1 ms to 100 s (1-2-5 steps).

Measurement Error (average value for S/N >16 dB) –
Digital Display; Range I: <1 dB. Range II: 0 to +55°C: <1 dB. –10 to 0°C: ≤1.5 dB. Range III: <2 dB.

Internal Level Calibration: Short or total calibration by keystroke. Generator: Sinewave and harmonics generator.

Frequency Drift (digital in kHz) –
Resolution: 0.1 to 100 Hz. Measurement Range: 0.5 IF bandwidth. Measurement Time: 1 ms to 100 s. Measurement error: Same as frequency error.

Frequency Deviation (digital in kHz) –
Resolution: 0.1/0.01 kHz. Measurement Range: Deviation + f_{mod} <0.5 IF bandwidth. Measurement Frequency f_{mod}: 1<100 kHz. Measurement Error (signal-to-noise >40 dB, AF = 1 kHz); IF Bandwidths 1, 3, 9, and 15 kHz: 100 Hz + 3% of measured value. IF Bandwidths 120 and 1250 kHz: 2 kHz + 3% of measured value.

Phase Deviation (bandwidths 1, 3, 9, 15 kHz) – Resolution: 0.1. Maximum Deviation: 8 rad. Modulation Frequency: 300 Hz to 5 kHz. Measurement Error (signal-to-noise >40 dB, m = 50%, AF = 1 kHz): 0.1 rad + 5% of measured value.

Modulation Depth (digital in %) –
Resolution: 0.1%. Measurement range 1 to 99%. Modulation Frequency f_{mod}: <100 kHz. Measurement Error (signal-to-noise >40 dB, m = 50%, AF = 1 kHz): 5% (absolute).

IF Analysis –
Frequency Display; Range I: 10 kHz to 2 MHz (1-2-5 steps). Range II and III: 10 kHz to 10 MHz (1-2-5 steps).

Level Display Range: 80 dB.

Attenuation Switchover (in IF path): 0/20 dB.

Resolution Bandwidth (–3 dB): 1, 3, 10 kHz.

Sweep Time: 50 ms to 10 s (1-2-5 steps).

Number of Test Curves: Maximum 2 traces.

Display Modes: Clr/Write, Max Hold, Min Hold, Average, View.

Marker: 2 markers with digital display of frequency and level.

Marker Functions: Normal marker, delta marker, marker-to-peak, marker-to-center frequency (= receiver frequency).

AF Demodulation Modes – Zero beat, 1 kHz beat, AM (for A3E emissions), USB and LSB (for SSB emissions), FM (for F3E emissions). Squelch: Adjustable with front-panel knob.

Trigger Functions – External: TTL level, positive- or negative-going edge. Internal: Controlled by RF level, threshold adjustable.

Date, Time of Day – Internal clock, permanently operated from internal battery.

EMI/Radio Monitoring Solutions

ESVB • ESVD • ESVN • ESN

INPUT/OUTPUT

Remote Control – IEC 625-2 (IEEE 488). Connector: 24-contact Amphenol connector. Interface functions: AH1, L4, SH1, T6, SR1, PP1, RL1, DC1, DT1, C1, C2, C3, C11.

Plotter – Via IEC/IEEE-bus interface. Plotter Language: HP-GL.

Printer – Connector: 15-contact Cannon connector, Parallel interface.

Keyboard – Connector: 5-contact DIN female.

Floppy Disk Drive – 3.5 in., 1.44 MB formatted, MS-DOS compatible.

Front-panel Outputs – Supply and Coding Connector for Antennas, etc.: 12-contact Tuchel connector.

AF output –
Connector: JK34 jack. Impedance: 10 Ω. EMF: Adjustable up to 1.5 V.

Generator output (tracking generator): (ESVN 30, ESN); Connector: N female. Impedance: 50 Ω. Bandwidth: ESVN 30, 20 MHz to 1 GHz; ESN, 9 kHz to 1 GHz. EMF: 96 dBµV ±1 dB.

Rear-panel Outputs –
IF 10.7 MHz (switch selected between leveled and unleveled IF voltage); Connector: BNC female. Impedance: 50 Ω. Bandwidth (–3 dB): IF bandwidth. EMF in range of analog level display for unmodulated sinewave signal: Operating range 30 dB, 1 to 30 mV; Operating range 60 dB, 1 mV to 1 V. Regulated Output: 700 mV.

AM/FM; Signal: Demodulated AF voltage. AM output voltage (EMF) (m = 50%, DC-coupled): 2 V p-p. FM (DC-coupled); Bandwidth 1, 3 kHz: 2 V/kHz. Bandwidth 9, 15 kHz: 0.2 V/kHz. Bandwidth 120, 250 kHz: 0.3 V/10 kHz. φM (AC-coupled): 0.2 V/rad.

I/Q Demodulator Outputs, AC-coupled (with Option 01 only); Connector: BNC female. Impedance: 50 Ω with external load >200 Ω. EMF (peak value regulated): 3 V, can be switched to external control). Bandwidth: 0.5 IF bandwidth. Phase error between I and Q for signal-to-noise >40 dB, output frequency 10 to 100 kHz: <1° typical.

CCVS Output; Connector: BNC female. Signal: Video polarity and vision/sound carrier offset can be selected for all TV standards.

Reference Output; Connector: BNC female. Function: Can be switched to input for external reference. Frequency: 10 MHz. Level: 7 dBm.

User Port; Connector: 25-contact Cannon connector. Function: Six TTL control lines for an external device (e.g., driven by RF level), analog voltage indication, input for external triggering, input for IF control, RS-232-C interface for firmware update.

Rear-panel Inputs –
External battery; Connector: 3-contact connector. Required voltage: 11 to 33 V.

Reference input; Connector: BNC female. Function: Can be switched to reference output. Level required: EMF >1 V from 50 Ω. Frequency: 5/10 MHz.

POWER REQUIREMENTS

AC Operation – Line voltage: 100 V, 120 V, 220 V, 240 V ±10%: 230 V +6%/–10%. Line frequency: 47 to 440 Hz. Power consumption: ESVN, 125 VA; ESN, 155 VA.

DC Operation – External Battery (switch-on voltage >12 V); Voltage Range: 11 to 33 V. Current Drain 24/12 V: ESVN, 3.7 A/6.8 A; ESN, 4.4A/8 A.

GENERAL SPECIFICATIONS

Environmental Characteristics – Rated Temperature Range: –10 to +55°C without condensation. Storage Temperature Range: –25 to +70°C. Mechanical Resistance: Shock-tested to MIL-STD-810 D (shock spectrum 40 g), Vibration-tested to MIL-T-28800 D, class 5; complies with IEC Publication 68-2-6. RFI Suppression: Complies with VDE 0876, Part 1a, Regulation 527/1979 and MIL-STD-461 B (CE03 and RE02).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	236	9.3
Width	435	17.1
Depth		
ESVN	460	18.1
ESN	572	22.5
Weight	**kg**	**lb.**
ESVN	29	63.9
ESN	32	70.5

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ESVB
Test Receiver.
Includes: Power Cable, Manual.

Opt. 01/ESVD-B1 – I/Q Demodulator.

Opt. 02/ESVD-B2 – Frequency Extension to 2.05 GHz. (Opt. 01 required).

ESVD
Test Receiver.
Includes: Power Cable, Manual.

Opt. 01/ESVD-B1 – I/Q Demodulator.

Opt. 02/ESVD-B2 – Frequency Extension to 2.05 GHz. (Opt. 01 required).

ESVN 20
Test Receiver.
Includes: Power Cable, Manual.

Opt. 01/ESS-B1 – Reference Oscillator OCXO.

ESVN 30
Test Receiver with Tracking Generator.
Includes: Power Cable, Manual.

Opt. 01/ESS-B1 – Reference Oscillator OCXO.

ESN
EMI Test Receiver.
Includes: Power Cable, Connector for External Battery, N-BNC Adapter, Viewing Hood, Operating Manual.

Opt. 01/ESN-B1 – Frequency Extension. 1 GHz to 2.050 GHz operation.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES
Also see page 438.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI Software
ES-K1

Features

ES-K1

- Fully Automatic and Interactive Operation for Maximum Speed, Reproducibility, and User Friendliness
- Automatic Compensation of Transducers (Correction Factors) and Limit Lines
- Evaluation of Narrowband/Broadband Interference
- Test Setup Calibration
- Convenient and Flexible Result Documentation
- Easy and Open-ended Expandability for System Applications Due to Modular Design

Applications

Conforms to following commercial and military standards:

Commercial:

- CISPR
- EN
- ANSI
- FCC
- EACL
- VDE

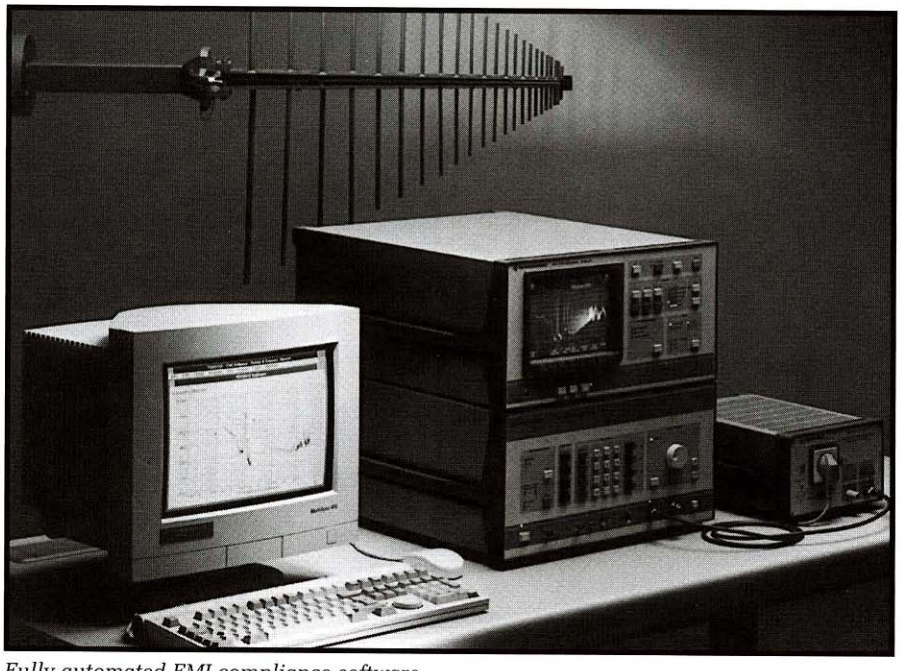
Military:

- MIL
- VG
- DEF-STAN
- GAM-EGI 3
- Can Be Adapted to Other Standards

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



Fully automated EMI compliance software.

ES-K1 EMI Software

ES-K1 EMI Software is an advanced, user-friendly tool which can be used for highly effective measurements for all conducted and radiated emission measurements. The number of measurements required for ensuring electromagnetic compatibility is ever increasing – and with it the demand to make these measurements reliable, reproducible, and economical.

ES-K1 EMI Software complies with these exacting requirements for measurements to both commercial standards (CISPR, EN, ANSI, FCC, EACL, VDE) and military standards (MIL, VG, DEF-STAN, GAM-EGI 3). Adaptation to other standards is possible.

When used with Rohde & Schwarz EMI test receivers and accessories, the ES-K1 EMI Test Software provides fully automatic operation. The interactive mode allows the operator to use his/her experience to the fullest for most accurate and thorough measurements. At the same time, operation under Windows provides easy access and operation for the first-time user. The friendly graphics user interface allows the operator to concentrate on the measurement at hand. Concise documentation of results in graphic and tabular forms is possible along with the associated test setup.

REQUIREMENTS

- PC-compatible controller fully compatible with Windows 3.1 with a minimum of 4 MB RAM
- Windows 3.1
- 4 MB available storage capacity on hard disk
- IEC/IEEE/488-bus interface with Windows driver (DLL), compatible with National Instruments IEEE 488-bus card AT-GPIB or PCIIA

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ES-K1
EMI Test Software.
Includes: Program Disks, Manual.

RECOMMENDED ACCESSORIES
Script Development Kit – Order ES-K2.

ESHS/ESVS/ESVD Driver – Order ES-K10.
ESS Driver – Order ES-K11.
ESAI/ESBI/ESMI Driver – Order ES-K12.
ESVP/ESH3 Driver – Order ES-K13.
ESVP/ESH3/EZM Driver – Order ES-K14.
FSA/FSB/FSM Driver – Order ES-K15.
EMCO 1050/1060 Driver – Order ES-K32.

EMI Test Receiver ESPC

EMC-compatible Development and Production

Features

- Correct Interference Weighting to CISPR 16-1 Down to 10 Hz Pulse Repetition Frequency
- Integrated Preselection
- For All Commercial EMI Standards (CISPR, EN, ETS, FCC, ANSI C63.4, VCCI and VDE)
- Automatic Overload Detection
- Power Sourcing From Internal or External Battery
- Easy-to-use Built-in Macro Functions
- Windows-based EMI Software is Provided as Standard Accessory

Introduction

The EMI Precertification Test Receiver ESPC has been derived from various Rohde & Schwarz full-compliance receiver models and thus enables versatile applications in the field of EMI pre-compliance. It is a budget-priced solution for emission tests of all stages of development and production of electrical products. With a view to obtaining the CE conformity mark, this test receiver will be used wherever EMI tests become necessary prior to acceptance testing in order to minimize the risks involved and the time taken for full-compliance tests.

Featuring built-in preselection, ESPC is able to perform accurate interference measurements with pulse repetition frequencies (PRF) to as low as 10 Hz in accordance with CISPR 16-1. An overload detection system for the complete receiver signal path, from the input through to the IF stages, warns the user of erroneous measurements.

SPECIAL FEATURES OF THE ESPC

- Frequency Range From 150 kHz to 1000 MHz
- Options for Frequency Extension to 9 kHz and 2500 MHz
- Parallel Detectors for Average, Peak and Quasi-peak Reading
- Fast Synthesizer: Frequency Resolution 10 and 100 Hz

POWERFUL PROCESSOR SYSTEM

- Macros for Automatic and Semi-automatic Test Routines
- Automatic Level Calibration
- Measurement of Voltage, Field Strength, Current and Pulse Spectral Density with Display of Relevant units
- Automatic Consideration of Frequency-dependent Transducer Factors

Since the ESPC has been designed for use in all stages of development and production, it offers a compact and economical solution in particular for:

- EMI Diagnostic Measurements,
- Pre- and Post-certification Tests,
- Production Tests.

With the aid of fast prescan measurements and subsequent evaluation, the ESPC measures the equipment under test for EMC compatibility. The ESPC can store settings of scan, bandwidth, limit lines and correction factors of frequency-dependent transducers as well as limit lines for relevant standards. The comparison with standard or user-defined limit lines allows immediate differentiation between critical and non-critical emissions of the EUT. With the aid of a variable acceptance value, uncertainties in the test setup or production tolerances can be taken into account.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI Test Receiver ESPC

EMC-compatible Development and Production

Due to the increasing number and higher frequencies of mobile radio services, useful and interfering emissions up to 2.5 GHz have often to be investigated although weighting of emissions in line with EN standards is specified up to a frequency limit of 1 GHz only. The ESPC provides an optional frequency range extension up to 2.5 GHz which can also be retrofitted.

COMPLETE TESTS AT A KEYSTROKE

Using the FAST PRESCAN function and peak and/or average detectors, the critical ranges of the spectrum can be determined and, to minimize the measurement time, the final measurement then correctly be carried out at the critical frequencies, using data reduction routines and quasi-peak and average detectors. Valuable measurement time can be saved which otherwise would be spent on ranges of no interest with low emission levels.

The test receiver automatically selects the correct CISPR bandwidths for the relevant test frequency. In conjunction with firmware macros for automatic test routines, comparisons with limit lines, for instance to EN standards, can conveniently be made.

Up to 22 different:

- Limit Lines
- Transducer Factors

can be stored in a built-in nonvolatile memory, ensuring high accuracy for every frequency step.

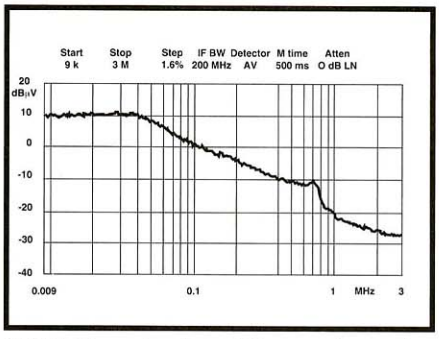
Users not specialized in EMI can also easily handle and carry out these reproducible test runs. The ESPC shows its true strength by making the following measurements at the press of a button:

- RFI Voltage,
- RFI Power,
- RFI Field Strength.

Moreover, the following test routines are available:

- Automatic Frequency Scan and
- Frequency List Measurements at up to 400 Frequencies.

A comprehensive test report can be output on a printer or plotter. This makes the ESPC an extremely useful tool in product development.



ESPC allows simple and time-saving performance of development-accompanying diagnostic measurements.

The report contains all the information required for reproducible measurement, such as user annotation, test receiver settings, graphs and final results.

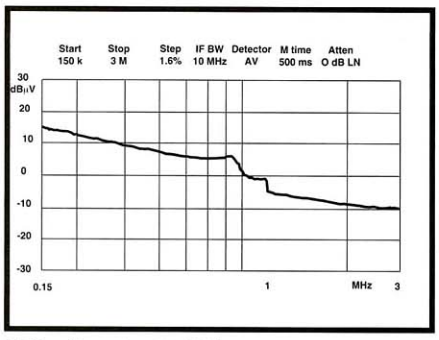
The final results of RFI voltage measurements are listed with the frequency and level for QP and AV values. Levels exceeding the limit line are marked by an asterisk, with phase and grounding being specified.

SOFTWARE-SUPPORTED EMI MEASUREMENTS

The Windows Software ESPC-K1 supplied with the ESPC supports EMI measurements in accordance with commercial standards. After setting of the measurement configuration and test parameters via pulldown menus, the results are displayed as graphs and lists on the screen of a PC. Following a prescan measurement, investigation and final measurement at the critical frequencies are made in automatic, semiautomatic interactive or manual mode. Marker and zoom functions facilitate analysis of spurious emissions. The ESPC is controlled via the IEEE 488 bus.

The test results can be output as graphs or lists on printers supported by Windows or as files. A complete RFI voltage test in line with EN55022 is shown in the illustration.

Note: In conjunction with artificial mains networks the ESPC should always be used with the Pulse Limiter ESH3-Z2 for safety reasons (see also recommended extras).



RFI voltage test to EN55022.

Characteristics

Data with tolerances are guaranteed values (all other data are typical or approximate values).

FREQUENCY RANGE

Lower limit – 150 kHz (optionally 9 kHz with ESPC-B2).

Upper limit – 1000 MHz (optionally 2500 MHz with ESPC-B3).

Frequency setting with tuning knob –
In 10-Hz, 100-Hz and 100-kHz steps or user-selectable.
Numerical: via keypad.
Automatic scan: for RF analysis.

Display – 8-digit LCD with backlighting, can be switched off.

Resolution – up to 1000 MHz: 10 Hz, from 1000 MHz: 100 Hz.

Frequency Error – $<3 \times 10^{-6}$, after 30 min warmup.

RF INPUT

VSWR, f_{in} <1 GHz – Z_{in} = 50 W, N female 1.5 with ≥10 dB RF attenuation, <2 with 0 dB RF attenuation.

RF attenuator – 0 to 70 dB, 10 dB steps.

MAXIMUM INPUT LEVEL

RF attenuation 0 dB Sinewave AC voltage – 130 dBµV.

Pulse spectral density – 97 dBµV/MHz (100 V x 0.5 ns).

RF attenuation ≥10 dB –
Sinewave AC voltage: 130 dBµV.
Max. pulse voltage: 150 V.
Max. pulse energy (10 µs): 10 mWs.

INTERFERENCE REJECTION, F <1000 MHZ

Image-frequency rejection, 1st and 2nd IF – 70 dB.

IF rejection – 70 dB.

EMI Test Receiver ESPC

EMC-compatible Development and Production

PRESELECTION
9 kHz to 1000 MHz – 2 fixed-tuned, 6 tracking filters.

1000 to 2500 MHz – 2 tracking filters.

RF SHIELDING
Voltage indication at a field strength of 3 V/m with 0 dB RF attenuation ($f=f_{in}$) – <0 dBµV.

Additional error in quasi-peak indication range (3 V/m) – <1 dB.

IF BANDWIDTHS
Nominal bandwidth – –3 dB, –6 dB.

200 Hz* (with option ESPC-B2) – 180 Hz, 200 Hz.

10 kHz*[1] – 7 kHz, 9.5 kHz.

120 kHz* – 90 kHz, 120 kHz.

*[1] *Tolerances to CISPR 16-1*

NOISE INDICATION, AVERAGE
9 kHz to 3 MHz, BW = 200 Hz with option ESPC-B2.
150 kHz to 3 MHz, BW = 10 kHz.

VOLTAGE MEASUREMENT RANGE
Lower limit (additional error due to inherent noise < 1 dB).

Average Indication (AV), f >3 MHz –
BW=200 Hz: typ. –28 dBµV.
BW=10 kHz: typ. –12 dµV.
BW=120 kHz: <+3 dBµV, typ. –2 dBµV.

Upper Limit AV, PK, QP – 130 dBµV (RF attenuation ≥10 dB).

LEVEL DISPLAY
Digital – In dBµV, dBµA, dBm, dBµV/m, dBµA/m, dBpW, 3-digit LCD with backlighting (can be switched off), resolution 0.1 dB.

Analog – On moving-coil meter in operating range of IF detector with digital display of lower range limit.

Operating Ranges – 30, 60 dB.

Overload Indication – by level detectors in RF and IF signal path.

Detectors – average (AV), peak (PK), quasi-peak (QP); 2 detectors can be switched on simultaneously.

Measurement times – 1 ms to 100 s (1/2/5 steps).

MEASUREMENT ERROR
Average Indication –
9 kHz to 1000 MHz: ≤1.5 dB, typ. 1 dB
1000 to 2500 MHz (optional): typ. 1 dB.

Quasi-peak Indication – to CISPR 16, ≥10 Hz pulse repetition frequency.

Level Calibration – Harmonics generator; calibrates the receiver for settings, correction values stored in nonvolatile memory, duration approx. 1 min.

Demodulation Modes – AM, FM, A0 (zero beat), internal loudspeaker, headphones connector.

Volume – Adjustable with rotary knob.

Day, Time of Day – Internal clock, permanently operated from internal battery.

INTERNAL MEMORY
Transducer – 22 transducer factors with up to 50 reference values, nonvolatile, can be combined.

Limit Lines – 22 limit lines with up to 50 reference values, nonvolatile.

Instrument Settings – 9 complete setups, nonvolatile.

AUTOMATIC MODES
Frequency Scan – Definable start and stop frequency and step size, max. 5 ranges with individual settings.

Frequency Lists – Automatic measurement of max. 400 frequencies.

RFI Voltage Measurements – Automatic control of artificial mains networks, determination of maximum values in up to 400 subranges, checking for out-of-tolerance values.

RFI Power Measurement – Interactive mode with MDS absorbing clamps, determination of maximum values in up to 400 subranges, checking for out-of-tolerance values.

RFI Field-strength Measurement – Interactive mode with automatic antenna switchover, determination of maximum values in up to 400 subranges, checking for out-of-tolerance values.

DOCUMENTATION
Plotter (IEEE 488) or Printer (Centronics) – Graphs with limit lines, settings and comments, frequency and level lists.

Scaling of Graphs – Linear or logarithmic frequency axis.

CONNECTORS AND INTERFACES
Remote Control – Interface to IEC625-2/IEEE488.2.

Remote-control Connector – 24-contact Amphenol connector.

Plotter – Via IEC/IEEE-bus interface.

Printer – Parallel interface (15-contact Cannon connector).

FRONT-PANEL OUTPUTS
Supply and Coding Connector for Antennas, etc. – 12-contact Tuchel connector.

AF output – Jack JK34, adjustable level.

REAR-PANEL OUTPUTS
IF 10.7 MHz – Z_{out} = 50 Ω BNC connector, bandwidth = IF bandwidth.

User Port – 25-contact Cannon connector for control of LISNs (phase switching) and antennas.

Keyboard Connector – 5-contact DIN connector for MF2 keyboard.

REAR-PANEL INPUTS
Reference Input – BNC connector.
Frequency: 10 MHz.
EMF: >1 V.
Frequency drift: see frequency error.

External Battery – 3-contact connector.

Required Voltage – 11 to 33 V (switch-on voltage >12 V).

GENERAL DATA
Rated temperature range – +5 to +45°C.

Operating temperature range – –10 to +55°C (no condensation allowed).

Storage temperature range – –25 to +70°C.

Mechanical resistance – Shock-tested to MIL-STD-810D (shock spectrum 40 g), vibration-tested to MIL-T-28800D, Class 5; corresponds to IEC Publ. 68-2-6.

EMC – Satisfies EMC directives of EU (89/336/EEC) and German EMC legislation.

Calibration Interval – 1 year.

Selftest – At a keystroke, detects faults down to module level.

Power Supply –
AC supply: 100/120/240 V ±10%, 230 V +6/–10%, 80 VA, 47 to 420 Hz, safety class I to VDE 0411 (IEC 348)
Battery (external): 11 to 33 V.

Dimensions (W x H x D), weight –
435 mm x 236 mm x 350 mm, 17 kg.

EMI Test Receiver ESPC

EMC-compatible Development and Production

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

EMI Test Receiver – ESPC. Order 1082-8007-10.
Includes: Windows Software ESPC-K1, Power Cable, Connector for External Battery, Operating Manual.

PC Configuration Required for Software ESPC-K1 – IBM-AT-compatible, 386 or higher.

OPTIONS

Internal Battery with Automatic Charging – ESPC-B1. Order 1082-9503-02.

Frequency Extension 9 kHz to 150 kHz and IF bandwidth 200 Hz – ESPC-B2. Order 1082-9555-02.

Frequency Extension 1000 to 2500 MHz – ESPC-B3. Order 1082-9603-02.

RECOMMENDED EXTRAS

Pulse Limiter (9 kHz to 30 MHz) – ESH3-Z2. Order 0357-8810-52.

10-dB Preamplifier (9 kHz to 30 MHz) – ESH3-Z3. Order 0827-8016-52.

10-dB Preamplifier (20 to 1000 MHz) – ESV-Z3. Order 0397-7014-52.

IEC/IEEE-Bus Interface for Operation of ESPC-K1 – PS-B4. Order 1006.6207.04.

IEC/IEEE-Bus Connecting Cable 1m – PCK. Order 0292.2013.10.

IEC/IEEE-Bus Connecting Cable 2m – PCK. Order 0292.2013.20.

Printer Cable – EZ-11. Order 0816.1767.02.

CONTROL CABLE FOR ARTIFICIAL MAINS NETWORKS

ESH3-Z5 (2m) – EZ-14. Order 1026.5341.02.

ESH2-Z5 (2m) – EZ-13. Order 1026.5293.02.

Service Kit – EZ-8. Order 0816.1067.02.

Headphones – Order 0100.2959.00.

Front Handles – ZZG-95. Order 0396.5176.00.

Transit Case – ZZK-953. Order 1013.0510.00.

Trolley – ZZK-1. Order 1014.0510.00.

Further accessories for EMI measurements (antennas, artificial mains networks, etc.), see ESS data sheet.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Wireless Communication Test Sets

CONTENTS

WIRELESS COMMUNICATION TEST SETS

CMD80 269
R3465/R3463 271
CRTC02 274
CMD55 277
CMD53 279
CTS55 282
CTD55 284
CMD59 286
CMD57 289

Wireless Communication Test Sets

SIGNALING

Radio test sets, covering major national and international standards, including CDMA, GSM, DCS 1800, PCS 1900 and AMPS are described here.

In addition to the conventional RF and AF measuring facilities, many units also include special signaling capabilities. Testers with signaling simulate the base station and perform all signaling measurements to PTT regulations, in addition to all conventional radio measurements. For large cellular-radio networks, they also provide base-station testing, including signaling.

Integration of a signaling unit into the radio tester ensures fast data exchange between the control units, thus creating the prerequisites for real-time measurements under practical conditions.

If in-depth spectral analysis is required, including modulation without signaling, refer to the Spectrum Analyzers section. In particular, see information on the FSEA Series, R3465, R3463, and R3263.

- CDMA Mobile Unit Test CMD80
- CDMA Base Station Test R3465/R3463 CDMA
- GSM Mobile Unit Test CRTC02, CMD55, CMD53, CTS55, CTD55
- GSM Base Station Test CMD57, CMD59

Communications Test Sets
CMD80

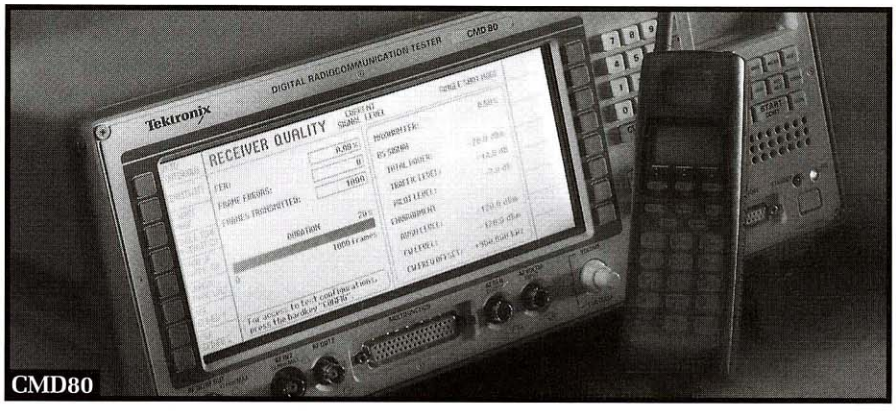
Features

CMD80

- Large LCD Display Enhances the Friendly User Interface
- 8 K/8 K EVRC/13 K VOCODER Support
- Dual-mode CDMA/Analog Measurements
- Cellular and PCS Frequencies in a Single Test Set
- New Protocol Monitor Function (Opt. 18)

Applications

- CDMA Mobile Testing



CMD80

CMD80 Digital Radiocommunication Tester

The CMD80 Digital Radiocommunication Tester is a compact tester for CDMA mobiles which provides full signaling capabilities. The mobile RF parameters are verified under similar conditions as found in a real network; i.e., the tester simulates a base station, makes a call to the mobile, and performs the measurements without any special test modes in the device-under-test. The CMD80 measures several key IS 95 parameters using IS 98 and J-STD-18 methods:

- FER service option 2
- Frame errors
- Waveform quality φ
- Error vector magnitude
- Phase error
- Magnitude error
- Carrier feedthrough
- Frequency accuracy
- Power measurements
- Base station signaling for mobile testing

SIMULATION OF A BASE STATION

The CDM80 simulates a CDMA (IS 95) base station and provides all the signaling necessary to hold up a call:

- Synchronization of mobile
- Registration of mobile
- Incoming/outgoing calls
- Handoffs

During the call, the tester verifies the RF performance and implicitly checks the correct operation of the basic signaling features.

The CMD80 does not rely on any special test modes in the mobile station and performs the measurements under conditions almost identical to those in the real network. A voice loop-back allows quick verification of mobile performance as it is perceived by the user.

EASY TO USE

The CMD80 is extremely user friendly and requires little detailed CDMA knowledge. The large high-contrast liquid crystal display provides softkeys on both sides to allow convenient call-up of test routines under menu control.

Easily, the user can switch to a menu and change the current settings of signaling and measurement parameters. The user is guided through the menus by explanatory text and may always return to the default setting with a push of a button.

FAST MEASUREMENTS

State-of-the-art digital technology leads to quick and efficient measurements for rho and power. In remote control mode via IEEE bus, the instrument is exceptionally fast and yields high throughput in production.

TEST CAPABILITIES

All essential characteristics of a CDMA mobile station can be tested with high accuracy. The CMD80 not only verifies the RF performance of a CDMA mobile but, in addition, checks software features of the mobile which are important for the correct operation of the network. In many cases, this avoids the need for expensive custom test beds in development and QA.

HIGH FLEXIBILITY

Almost every signaling and measurement parameter can be modified by the user in the configuration menus, either dynamically during a test or in advance. Even the tolerances for pass/fail verdicts can be changed to match the requirements of the application.

DC MEASUREMENTS

The DC ammeter/voltmeter designed for pulsed signals allows correct measurement of the power consumption of the mobile station.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2.*

Tektronix

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Set
CMD80

Characteristics

SIGNAL GENERATOR

Frequency –
PCS (US) 1930 to 1990 MHz;
PCS (Korea) 1805 to 1870 MHz;
US Cellular Range: 869 to 894 MHz;
Resolution: 1 Hz; Error: Same as timebase.

Output Level –
RF IN/OUT: –20 to –124 dBm; RF OUT 2: +5 to –105 dBm; Resolution: 0.1 dB; Error (RF IN/OUT): ≤1.5 dB.

Modulation –
Carrier suppression: –30 dBc.

ANALYZER

Frequency –
PCS (US) 1850 to 1910 MHz;
PCS (Korea) 1715 to 1780 MHz;
US Cellular Range: 824 to 849 MHz;
Resolution: 1 Hz; Error: Same as timebase.

Power Measurement –
Reference level range: RF IN/OUT (full scale): +41 to –28 dBm; RF IN 2 (full scale): 0 to –69 dBm.
Measurement error: Absolute: ±1.5 dB; Relative: ≤0.4 dB (reference level to –40 dB); Dynamic range: 50 dB below reference level.

Modulation Analyzer –
ρ error (25 ±10° C): 0.003 (for ρ 0.9 to 1); Frequency measurement range: ±3 kHz; Frequency measurement error: Reference ±30 Hz; Timing measurement error: ±60 ns.

Time Base –
Standard: Nominal frequency: 10 MHz; Frequency drift (0 to 35°C): $\leq 1.5 \times 10^{-6}$; Frequency aging (at 35°C): $\leq 0.5 \times 10^{-6}$/year; With OCXO time base, Option 01: Nominal frequency: 10 MHz; Frequency drift (0 to 45°C): $\leq 1.1 \times 10^{-7}$; Frequency aging (after 30 days operation): $\leq 2 \times 10^{-7}$/year; $\leq 0.5 \times 10^{-9}$/day;
Warm-up time (at 25°C): Approx. 5 minutes.

REFERENCE FREQUENCY INPUTS/OUTPUTS (OPTION 03)

Synchronization Input –
Frequency (selectable): 100 kHz to 50 MHz, step 10 kHz; Impedance: Approx. 100 Ω; Level: 0 dBm to TTL.

Synchronization Output –
Frequency: 10 MHz or frequency at synchronization input; R_{out}: 50 Ω; Level: TTL.

AWGN (Additive White Gaussia Noise) GENERATOR (OPTION 02)

Equivalent Noise Bandwidth –
1.8 MHz, typical.

Gain Adjustment Range – –20 to +6 dB of forward channel power.

DC VOLTAGE MEASUREMENTS

Range – 0 to ±30 V.

Resolution – 10 mV.

Error – 2% + resolution.

DC CURRENT MEASUREMENTS

Mode – Averaging, + peak, – peak.

Range – 0 to ±10 A.

Common-mode Rejection – ±30 V.

Shunt Resistance – 50 mΩ.

Resolution for Averaging – 1 mA/10 mA.

Resolution for Peak – 10 mA.

Residual Indication – <10 mA.

Error – <2 % + resolution + residual indication.

ENVIRONMENTAL

Operating Temperature – 0 to +45°C, to DIN IEC 68-2-1/2.

Storage Temperature – –40 to +60°C.

Electromagnetic Compatibility –
Corresponds to the requirements of European EMC directive (89/336/EEC).

POWER SUPPLY

Line Voltage – 110 to 120 V AC ±10%; 200 to 240 V AC ±10%.

Line Frequency – 50 to 400 Hz ±5%.

Electrical Safety – VDE 0411, Class 1, IEC 1010-1, EN 61010 part d.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	363	14.3
Weight	**kg**	**lb.**
Without options	Approx. 15	Approx. 33

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CMD80
Digital Radiocommunication Tester.
Includes: Power Cord, Manual.

Opt. 01/CMD-B1 – OCXO Reference Oscillator. Ensures high absolute accuracy, minimum temperature-dependent drift, and especially high long-term stability.

Opt. 02/CMD-B81 – Noise Generator. Allows testing mobile with additional noise (requires Opt. 04 Adapter).

Opt. 03/CMD-B3 – Reference Frequency Inputs/Outputs.

Opt. 04/CMD-B60 – Adapter for Opt. 07 and Opt. 08.

Opt. 07/CMD-B61 – IEEE Bus Interface.

Opt. 08/CMD-B62 – Memory Card Interface (requires Opt. 04 Adapter).

Opt. 14 – Rate Set 2 (13 K) Support CMD-B14.

Opt. 15 – Delete PCS.

Opt. 16 – Delete Cellular.

Opt. 17 – Analog Meas. Option.

Opt. 18 – Message Monitor Software.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES – Also see page 438.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2.*

Tektronix

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New R3465/R3463 Opt. 61/R3561L CDMA Base Station Testers

Features

R3465/R3463 w/OPT. 61 AND R3561L

- Full-featured, CDMA-Specific Testing in Accordance with IS97 (code domain power, waveform quality, etc.)
- Full-function Spectrum Analysis to 8 GHz (R3465) or 3 GHz (R3463) for OBW, Spurious Emissions Measurements, etc.
- Cellular and PCS Frequencies in a Single Test Instrument

Applications

- CDMA Base Station Transmitter Measurements (Opt. 61)
- CDMA Base Station Transmitter/Receiver Measurements (R3561L Signal Generator with Opt. 61)
- Ideal for Design, Production, Installation, and Maintenance of CDMA Base Stations

R3465/R3463 CDMA Base Station Test Set

The R3465/R3463 CDMA Base Station tester combines a powerful modulation spectrum analyzer with CDMA-specific measurement capability to provide an unequaled combination of test functionality and portability.

COMPLETE CDMA BASE STATION TESTER

The R3465/R3463 combines full function spectrum analysis with CDMA-specific measurements in a single, complete test set. Option 61 provides CDMA measurements/constellation analysis with graphics capabilities. Addition of R3561L Signal Generator results in a combined system for complete TxRx CDMA testing. R3561L attaches to the top of the R3465/R3463 and is completely controlled through the R3465/R3463 front panel.

ESSENTIAL CDMA MEASUREMENTS

The R3465/R3463 with Option 61 and R3561L provides the following measurement capability:

- Code Domain Power and waveform Quality
- Modulation Measurements Including I/Q Diagrams
- Spectrum Analysis up to 8 GHz (R3465) or 3 GHz (R3463) for IS97 Spectrum Measurements
- Reverse Link Signal Simulation for Receiver Measurements.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Communications Test Sets

New R3465/R3463 Opt. 61/R3561L CDMA Base Station Testers

Characteristics

NOTE: Following specifications are with Opt. 61 and R3561L only. Refer to the R3465/R3463 catalog pages for spectrum analyzer specifications.

CDMA BASE STATION TESTING (OPTION 61 AND R3561L ONLY)

Output Frequency –
Range: 50 MHz to 2000 MHz.

Resolution – 1 Hz.
Accuracy: Based on the reference source accuracy.

Output Level –
Range: –125 dBm to 0 dBm.
Resolution: 0.21 dB.
Accuracy (frequency ≤1000 MHz):
Output level –120 dBm to 0 dBm: ≤±1.5 dB.
Output level –125 dBm to –120.1 dBm: ≤±2.5 dB.
Output level –110 dBm to 0 dBm: ≤±1.5 dB.
Output level –125 dBm to –110.1 dBm: ≤±2.5 dB.

Signal Purity –
Harmonics (output level 0 dBm): ≤–30 dBc.
Non-harmonics (frequency offset >5 kHz): ≤–55 dBc.
Adjacent Channel Noise (BW 30 kHz, frequency offset 900 kHz, output level 0 dBm): ≤–45 dBc.

Modulation –
Reverse Link:
Modulation Method: OQPSK (EIA/TIA/IS-95).
Channel: Traffic channel.
Data rate:
9600/4800/2400/1200 bps.
14400/7200/2600/1800 bps.
Data source:
600 frames (ZEROS/RANDOM/RANDERR).
600 frames (user, written via GPIB).
Forward Link:
Modulation method: QPSK (EIA/TIA/IS-95).
Channel: Pilot channel.
Waveform Quality: r ≥ 0.96.
PN Offset: 0 to 511 (x 64 chips).
Long Code Mask: 42 zeros.
Burst ON/OFF Ration: ≥20 dB.

Reference Source –
Synthesizer Reference Input
Frequency:
19.6608 MHz, 15 MHz, 10 MHz, 9.8304 MHz, 5 MHz, 4.9152 MHz, 2.4576 MHz, 2 MHz, 1.2288 MHz.
Level: 0 dBm to +23 dBm.
Input impedance: 50 Ω.
Connector: BNC.
CDMA base input:
Frequency:
19.6608 MHz, 15 MHz, 10 MHz, 9.8304 MHz, 5 MHz, 4.9152 MHz, 2.4576 MHz, 2 MHz, 1.2288 MHz, 1 MHz, INTERNAL.
Level: 0 dBm to +23 dBm.
Input impedance: 50 Ω.
Connector: BNC.
Even Second Sync Input:
Level: 2 second TTL.
Connector: BNC.
10 MHz Reference Output:
Frequency: 10 MHz.
Level: ≥0 dBm.
Impedance: 50 Ω.
Connector: BNC.
CDMA Clock Output:
1.2288 MHz:
Level: TTL.
Impedance: 50 Ω.
Connector: BNC.
19.6608 MHz:
Level: TTL.
Impedance: 50 Ω.
Connector: BNC.
20 ms/26.67 ms/80 ms/ Even Second::
Level: TTL.
Connector: 9-Pin D-sub.

Other I/O –
RF OUT:
Max. reverse input power: 2 W.
SWR (output level <–10 dBm): ≤1:1.5.
Impedance: 50 Ω.
Connector: N-type.
Serial I/O: Dedicated interface for R346x series.
REF UNLOCK: Lit at RF-SYNTHESIZER/ CDMA-TIMEBASE PLL UNLOCK.

CDMA MEASUREMENTS (OPTION 61)

Channel Input (IS-95 Channel 1 to 777, 1013 to 1023, channel offset possible) –
1.7 GHz Band: 0 to 1300.
1.9 GHz Band: 1 to 243.

Level Offset – Adjustable.

Channel Power Measurement – Integration of 1.2288 MHz.

Occupied Bandwidth Measurement –
Occupation factor setting possible.
Template display (after sweep and power calculation).
Standard template or user-defined template.
PASS/FAIL function.

Spurious Measurement (in band) –
Forward Link:
Template display (after sweep and power calculation).
Standard template or user-defined template.
PASS/FAIL function.
Reverse Link (absolute value mode):
Template display (after sweep and power calculation).
Standard template or user-defined template.
PASS/FAIL function.
Reverse Link (relative value mode):
Template display (after sweep and power calculation).
Standard template or user-defined template.
PASS/FAIL function.

Communications Test Sets

New R3465/R3463 Opt. 61/R3561L CDMA Base Station Testers

Waveform Quality Measurement –
Forward Link:
Rho measurement accuracy: <±0.005.
Tau measurement accuracy: <±300 ns.
Constellation and E.V.M. vs Chip graph display.
Reverse Link:
Rho measurement accuracy: <±0.003.
Tau measurement accuracy: <±300 ns.
Frequency error measurement accuracy: ±10 Hz.
Constellation and E.V.M. vs Chip graph display.

Code Domain Power Measurement (when IS-97 Base Station Test Model signal is input) –
Precise Mode (measurement with 64 x 20 chip):
Rho measurement accuracy: <±0.001.
Tau measurement accuracy: <±300 ns.
Frequency error measurement accuracy: ±10 Hz.
τj: <±10 ns.
$\Delta\theta i$: <±0.57 degree.
Normal Mode:
Rho measurement accuracy: <±0.003.
Tau measurement accuracy: <±300 ns.
Frequency error measurement accuracy: ±10 Hz.

Gated Output Power Measurement (20 ms sweep, 3 MHz RBW, zero span) –
Standard template or user-defined template.
PASS/FAIL function.

ON/OFF Ratio Measurement –
5 ms sweep, 3 MHz RBW, zero span).

Burst Envelope/Spectrum Measurement –
waveform ZOOM function.
Gated sweep setting function.
Pre-trigger and trigger delay setting function.

21.4 MHz IF Output – Cannot be used when Opt. 61 is installed.

POWER (R3561L ONLY)
Line Voltage – 100 to 120 VAC, 200 to 240 VAC,auto-switching.

Line Frequency – 50 Hz/60 Hz.

Power Consumption – 150 VA.

PHYSICAL CHARACTERISTICS

Dimensions (R3561L only)	mm	in.
Height	110	4.33
Width	350	13.78
Depth	420	16.54
Weight	**kg**	**lb.**
Net	10	22

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

R3465
Modulation Spectrum Analyzer, 9 kHz to 8 GHz.
Includes: Power Cord, Operating Manual.

R3463
Modulation Spectrum Analyzer, 9 kHz to 3 GHz.
Includes: Power Cord, Operating Manual.

OPTIONS
Opt. 09 – R3463/65 LO OUT for R3561L SG.
Opt. 15 – Controller option for user-defined automated routines.
Opt. 61 – CDMA transmitter measurements (Code domain power, waveform quality, I/Q measurements.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

R3561L – Reverse link signal source simulation for receiver testing (requires Opt. 09).

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Communications Test Sets
CRTC02

Features

CRTC02

- Automatic Measurements and Logging Using Supplied Test Procedures
- Built-in TTL Inputs/Outputs in the Transmit and Receive Path
- Fast and Reliable Testing of Modules and Complete Mobile Stations
- Automatic Test Routines
- Simulate Base Station with Call Setup, Data Transfer, and All Signaling Procedures Between CRTC02 and the Station-Under-Test
- Log All Signaling Activities in OSI Layers 1, 2, and 3 for Protocol Analysis; Mnemonic Display of Message Content for Protocol Troubleshooting
- Check Error-correction Facilities of the Mobile Station by Implanting Errors in the Data Stream
- Transmitter Measurements:
  - Power Ramp and Phase Trajectory
  - Burst Delay
  - Frequency Error
- Receiver Measurements:
  - Bit Error Rate in Real Time
  - Receiver Sensitivity
- Speech Coder and Decoder Tests
- Numerical and Graphical Output of Results
- IEC/IEEE Bus Interface (Option 04)

Applications

- Measurements on GMSK-modulated RF Signals and Receiver Testing
- Testing for Compliance with GSM, DCS 1800, and PCS 1900 Recommendations
- Simple Generation of Customized Test Procedures
- Research and Development
- Quality Assurance

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

CRTC02 Radiocommunications Test Set

The CRTC02 provides signal generation, signal measurement, and user-friendly software. They are extremely powerful test sets, providing all simulation and analysis capabilities – from measurement of GSM/DCS 1800/PCS 1900 – specific signals to detailed checking for hidden errors in signaling.

SIGNAL GENERATION

The analog unit provides two independent RF generator channels. Using these two channels, the test set can simultaneously simulate and test a control channel (BCCH + FCCH + SCH + CCCH) and a traffic channel (TCH + SACCH). For measuring the receiver sensitivity, a fading simulator can be connected into each of the output circuits.

Transmission with or without frequency hopping is possible on all channels. The two channels are GMSK-modulated and are timed as bursts to occupy exactly one or all of the eight GSM/PCN time slots. The timing of the bursts can be adjusted and the amplitude can be varied dynamically over a 40 dB range.

SIGNAL MEASUREMENT

A receive channel is allocated to each of the generator channels. It's offset by a duplex spacing of 45, 75, or 80 MHz relative to the generator channel, even under hopping conditions.

The digital signal is recovered by a precise GMSK demodulator. In addition, the signal in each of the receive channels is sampled. The phase and amplitude samples are stored and used for computing the signal parameters, such as burst delay, phase trajectory, and power ramping.

USER-FRIENDLY SOFTWARE SAVES

For development and quality control tasks, full flexibility is given by the possibility of varying procedures, signaling parameters, and results display. For production testing, overview measurements, and service tasks, complete test routines supplied with the equipment ensure reliable test results and ease of operation.

A menu-driven editor in conformance with coding rules 4.08 allows convenient entry of messages and system information simply by filling out tables.

A comfortable, window-oriented user interface simplifies the generation of test routines. Test programs are written in Borland Turbo C++. The use of this popular standard language eliminates the long training periods needed for special test languages and offers the user high flexibility.

The complete software, including message library, control programs, and test results, is stored on a hard disk. The built-in floppy drive permits loading stored data and easy backup.

The digital unit may further be used as an IEC/IEEE controller, allowing extension of the test set by including external instruments. The test sets contain both the IEC/IEEE bus interface and the necessary software drivers.

STANDARD MEASUREMENTS

The CRTC02 is supplied with an extensive test software package. These test programs are available in source code and can also be used as starter programs for generating user-specific programs by modifying programs or writing new ones.

The test routines fully comply with specifications:

- Receiver sensitivity in speech channel (TCH/FS) and in user-data and control channels
- Receiver input level range
- Layer 2 signaling of mobile station
- Call setup (mobile station originated and terminated call)
- Absolute delay and timing advance
- Delay measurement function
- Intra-cell power change
- Transmitter power control
- Phase and frequency error
- Power ramp of burst

In addition to the supplied software, other programs are available for test and measurements exactly in line with specifications for type-approval testing.

Communications Test Sets

CRTC02

SIGNALING
The CRTC02 accurately simulates the functions of an ideal base station. For troubleshooting on the unit-under-test, the signaling parameters can also be varied.

All layer 1 channel coding, as well as layer 2 signaling, is automatically performed in real time. The layer 3 signaling sequence is defined by special test programs.

PROTOCOL ANALYSIS
Every transmitted or received layer 2 or layer 3 message, or even the bits of a burst, are marked with a frame number and recorded in the log memory. Depending upon whether everything is logged or just selected logical channels, the log can cover a interval between ten seconds and 15 minutes. The logged messages are displayed in mnemonic form on the screen, using the same basic mask as the message editor.

BURST ANALYSIS
After data have been logged, power ramping as well as phase and frequency errors are calculated and displayed as a whole. Detailed analysis is supported by the zoom function.

To check the timing-advance measurement function of a mobile station, the CRTC02 measures the arrival of the burst and monitors the response of the mobile station to timing advance commands in the generator channels.

To check the delay measurement function of a base station, sending the burst can be delayed and the response of the station-under-test monitored.

To permit synchronization of external measuring instruments, a spectrum analyzer for example, the CRTC has a trigger output for automatically starting measurement at the beginning of a burst.

TESTING RECEIVER SENSITIVITY
In the loop-back mode, bit error rates (BER) can be measured in real to test the receiver sensitivity of a mobile station.

The same test can be made on base stations by applying a signal modulated with a CCITT test pattern to the receiver input.

ACOUSTIC TESTS
These tests are supported by the built-in speech coder function and the Digital Audio Interface (DAI) of the mobile station as defined in Recommendation 11.10.III.6.4.

A serial EMMI is provided for remote control of the mobile station.

AF MEASUREMENTS (OPTION 01)
A wide range of audio measurements can be performed on the AF section of the station-under-test. The AF generator provides single or double tones. The following measurement functions are implemented:

- AF voltmeter with RMS or peak weighting
- Continuously tunable distortion and SINAD meter
- AF frequency counter
- DC ammeter/voltmeter

Characteristics

ANALOG UNIT
SIGNAL GENERATOR
Frequency Range –
GSM band: 935 to 960 MHz;
DCS 1800 band: 1805 to 1880 MHz;
PCS 1900 band: 1930.2 to 1989.8 MHz.

Hop Size – Any frequency step within GSM, DCS 1800, or PCS 1900 bands.

Frequency Fine Tuning – 0 to 60 Hz with about 2 Hz resolution.

Frequency Setting – <500 µs (to within <4° of final phase).

Spurious Phase Modulation – <1° RMS, <4° peak.

Frequency Drift – $<2 \times 10^{-9}$/° C

Aging (after 30 days operation) – $<2 \times 10^{-9}$/day.

Maximum Output Level – 13 dBm.

Static Attenuation Setting – 0 to 135 dB. Resolution: 5 dB.

Dynamic Attenuation (electronic) – 0 to 35 dB.

Level Error (dynamic attenuation 0 dB) – <1.5 dB from – 122 to +13 dBm.

Modulation – GMSK, bit rate 270833 bit/s to GSM Rec. 05.04.

Burst Delay – –4.6 to +4.6 ms, variable in 0.46 steps.

ANALYZER
Frequency Range –
GSM band: 890 to 915 MHz;
DCS 1800 band: 1710 to 1785 MHz;
PCS 1900 band: 1850.2 to 1909.8 MHz.

Reference Level for Full Dynamic Range (adjustable in 3 dB steps) –
RF IN/OUT: 9 to 36 dBm;
RF IN 2: –21 to +6 dBm.

Level Error – <2 dB.

Sampler – Two 12-Bit A/D converters for I and Q signals, sampled at 1.083 MHz (4 samples per bit).

SYNCHRONIZATION
10 MHz output, 10 MHz input/output, 52 MHz output, slot sync output.

INPUTS/OUTPUTS
Fading Simulator – Two type N connectors, 50 Ω per channel.

Output Level – 8 to 13 dBm.

RF IN/OUT and RF IN 2 – N-type female connectors, 50 Ω.

Speech Coder Input –
Full dynamic range: 20 mV to 2 V;
R_{in}: 100 kΩ.

Speech Decoder Output –
Full dynamic range: 2 V;
R_{out}: <3 Ω.

Audio Monitor – Built-in loudspeaker, headphones connector, volume control.

Modes – Voltmeter, AF generator, speech decoder, speech coder.

DIGITAL UNIT
Processor – 80486 DX, 33 MHz.

RAM – 8 MB.

Hard Disk – 200 MB.

Floppy Disk Drive – 3.5-in., 1.44 MB.

Graphics – VGA.

Interfaces – IEC-625/IEEE 488 bus; RS-232C; Centronics; Keyboard connector on front and rear panels; CODEC input/output; Control interface; DAI/EMMI.

AF MEASUREMENT UNIT (OPTION B1)
AF GENERATOR
Signal Source –
Single or dual tone:
Frequency range: 20 Hz to 20 kHz;
Output level (RMS): 10 µV to 5 V;
Output impedance: <3 Ω.

AF Voltmeter –
Modes: RMS, + Peak, – Peak;
Frequency range: 50 Hz to 20 kHz;
Level range (RMS): 0.1 mV to 30 V.

Weighting Filters –
CCITT filter: To CCITT 0.41;
Programmable highpass filter: 107 Hz to 10.6 kHz;
Programmable lowpass filter: 235 Hz to 21 kHz;
Programmable notch filter: 100 Hz to 5 kHz (notch frequency).

Communications Test Sets

CRTC02

Distortion and SINAD Meter –
Fundamental frequency range: 100 Hz to 5 kHz;
Measurement range: 0 to 50%, 1 to 50 dB.

AF Frequency Counter –
Frequency range: 20 Hz to 500 kHz;
Resolution: 0.1 Hz/1 Hz.

DC Measurements –
Voltage: 0 to ±30 V;
Current: 0 to ±10 A.

I/Q INPUTS/OUTPUTS
I/Q Inputs for Up/Down Converter –
Adjustable level and level offset.

I/Q Outputs for Up/Down Converter –
Fixed level ±1.5 V (peak).

LAYER 1 FUNCTIONS
Channels Supported – C0 channel with FCCH + SCH + BCCH + CCCH + SDCCH/4 + SACCH/C4 TCH/SDCCH channel with TCH + FACCH + SACCH or SDCCH/8 + SACCH/C8 (TCH is TCH/FS or TCH/F9.6, TCH/F4.8, TCH/F2.4, TCH/H4.8, TCH/H2.4.

Ciphering and Frequency Hopping –
With or without on all channels.

LAYER 2 FUNCTIONS
Signaling – All logical channels for SAPI 0 and 3.

User Data – Transparent mode.

LAYER 3 FUNCTIONS
Defined by user programs.

Programming Language – Borland C++.

Starter Programs – Included for key test runs.

GSM-SPECIFIC MEASUREMENTS
Bit Error Rate – Measurement of receiver sensitivity in loop-back mode.

Phase/Frequency Error, Peak Transmitter Carrier Power, Burst Delay, and Simulation of Delay in Downlink/Uplink – To GSM recommendations.

PRESENTATION OF RESULTS
GSM-specific Measurements –
Graphical or numerical.

Messages and Signaling (content of log memory) – Alphanumeric in mnemonic form.

ENVIRONMENTAL
Temperature –
Operating: 0 to +45°C;
Storage: –40°C to +70°C.

POWER
Line Voltage – 110/220 V ±10%.

Line Frequency – 47 to 63 Hz.

Power Consumption – 500 VA.

PHYSICAL CHARACTERISTICS

ANALOG UNIT

Dimensions	mm	in.
Height	236	9.1
Width	435	17.1
Depth	570	22.4
Weight	**kg**	**lb.**
Without options	Approx. 28	Approx. 61.7

DIGITAL UNIT

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	570	22.4
Weight	**kg**	**lb.**
Without options	Approx. 18	Approx. 39.7

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CRTC02
Mobile Station Radiocommunication Test Set for GSM, DCS 1800, and PCS 1900.
Includes: Analog Unit, Digital Unit, Keyboard, Monitor, Basic Software, Borland C Compiler, CRTP-K21 PCN (DCS 1800) Software.

Opt. B1/CRTP-B1 – AF Measurement Unit.

Opt. B7/CRTP-B7 – I/Q Inputs/Outputs.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Test SIM Card – Order CRT Z2.

GSM/DCS 1800 Phase 2 Basic Software – Order CR02 PH2.

SMS/TDS Phase 2 Basic Software for GSM/DCS 1800 – Order CR48 PH2.

Ciphering Software – Order CRTS-K1.

Ciphering Software (A5-2) – Order CRTS K2.

Test Cases GSM 11.10 DCS – Order CRTP K22.

Test Cases GSM 11.10 DCS Call Control – Order CRTP K23.

Test Cases GSM 11.10 DCS – Order CRTP K24.

Test Cases For Acoustic Measurement GSM 11.10 DCS – Order CRTP K26.

GSM Phase 1 Test Case – Order CRTS K22.

GSM Phase 1 Test Case – Circuit Switched Call Control. Order CRTS K23.

GSM Phase 1 Test Case – Order CRTS K24.

GSM Phase 1 Audio Test Case – Order CRTS K26.

S/W for Data Services – Order CRTS K28

S/W for Supplementary Services – Order CRTS K38

S/W for Transparent Data Services – Order CRTS K48

GSM Phase 2 Test Cases (A) – Order CRTP K52.

GSM Phase 2 Test Cases (B) – Order CRTP K53.

GSM Phase 2 Test Cases (C) – Order CRTP K54.

GSM Handover Test Phase 2 – Order CRTP K55.

GSM Test Cases Phase 2 – Order CRTP K56.

GSM Phase 2 Supplementary Service Test Case – Order CRTP K58.

GSM Phase 2 SMS Test Case – Order CRTP K59.

DCS 1800 Phase 2 Test Case (A) – Order CRTP K62.

DCS 1800 Phase 2 Test Case (B) – Order CRTP K63.

DCS 1800 Phase 2 Test Case (C) – Order CRTP K64.

DCS 1800 Handover Test Phase 2 – Order CRTP K65.

DCS 1800 Test Cases Phase 2 – Order CRTP K66.

DCS 1800 Supplementary Service Test Case – Order CRTP K68.

DCS 1800 Phase 2 SMS Test Case – Order CRTP K69.

ADDITIONAL ACCESSORIES – Also see page 438.

1 year software upgrade contracts available.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets
CMD55

Features

CMD55

- Low Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit LCD Screen with Large Characters and Simultaneous Indication of All Settings and Results
- Softkey Menu Control for Operator Convenience
- Remote Control via IEC/IEEE Bus (with Opt. B61)

TEST FUNCTIONS (BASIC UNIT)

- Mobile Synchronization
- Location Update
- Incoming Call Setup
- Outgoing Call Setup
- Mobile Power Level Control
- Channel Charge
- Peak Power Measurements
- SACCH Measurements (e.g., RxLev, RxQual, Power Level)
- Echo Test
- Call Clearing by Mobile
- Call Clearing by CMD55

Applications

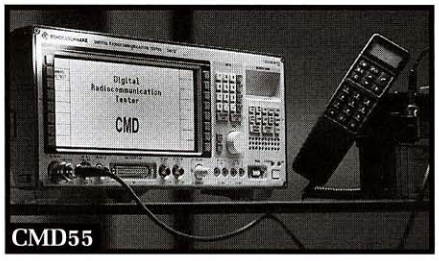
- GSM (Global System for Mobile Communications) Testing
- DCS 1800
- PCS 1900

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2 with SCPI conformance.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



CMD55

CMD55 Digital Radiocommunications Tester

The CMD55 Digital Radiocommunications Tester is a compact unit for testing GSM (Global System for Mobile communications), PCN (DCS 1800), and PCS (PCS 1900) mobiles. It combines small dimensions with high measurement accuracy and speed.

The range of capabilities offered by the CMD55 includes all signaling, generator, and measurement functions required for verifying the correct operation of the device-under-test. GO/NO-GO tests and accurate analysis using optional extensions makes the CMD55 equally well suited for service and production.

SIMPLE OPERATION

Operation of the CMD55 is extremely user-friendly and requires no detailed GSM knowledge in order to make accurate measurements. The high-contrast, backlit LCD provides a clear display of measurement results. Softkeys along both sides of the display allows convenient call-up of test routines under menu control. Selected parameters and measured values are displayed in easy-to-read form.

Various specific parameters are preset and permit direct testing without any operator control. The operator can modify all parameters individually in the configuration menus for customized testing.

TEST CAPABILITIES

For testing mobile phones, the CMD55 simulates a GSM, PCN, and PCS (with Opt. B19) base station. Using its two RF synthesizers, it delivers a continuous BCCH signal in addition to the TCH.

Characteristics

Time Base TCXO (standard) – Nominal frequency: 10 MHz. Frequency drift (0 to 35°C): ≤1.5 x 10^{-6}. Aging (at 35°C): ≤0.5 x 10^{-6}/year.

Time Base OCXO (with Opt. B1) – Nominal frequency: 10 MHz. Frequency drift (0 to 50°C): ≤1 x 10^{-7}. Aging: ≤5 x 10^{-9}/day (after 30 days of operation); ≤2 x 10^{-7}/year. Warmup time (at 25°C): Approx. 5 minutes.

Time Base OXCO (With Opt.B2) –
Nominal Frequency: 10 MHz.
Frequency Drift (0°C to 50°C):
Referenced to 25°C: ≤5 x 10^{-9}.
Instrument turned by 90° (at 25°C): ≤1 x 10^{-8}.
After 2 hour warm-up at 25°C after 24 hour out-of-service: ≤5 x 10^{-9}.
Aging: ≤3.5 x 10^{-8}/year, ≤5 x 10^{-10}/day after 30 days of operation.
Warmup time (at 25°C): Approx. 10 minutes.

RF GENERATOR 1

Frequency Range – GSM band: 935.2 to 959.8 MHz; DCS 1800 band: 1805.2 to 1879.8 MHz; PCS 1900 band (Opt. B19): 1930.2 to 1909.8 MHz.

Frequency Error – Same as time base.

Resolution – Same as channel spacing in the GSM and DCS bands.

Frequency Setting Time – ≤3 ms for phase error <2°.

Output Level – RF IN/OUT: GSM and DCS 1800 band: –35 to –120 dBm; PCS 1900 band (Opt. B19): –37 to –120 dBm.

RF OUT 2: GSM and DCS 1800 band: +11 to –77 dBm; PCS 1900 band (Opt. B19): +9 to –77 dBm.

Resolution – 0.1 dB.

Level Error – RF IN/OUT: ≤1.5 dB (≤1 dB at –104 dBm); RF OUT 2: ≤2 dB.

Harmonics RF IN/OUT – <–30 dBc.

Modulation – GMSK, B x T = 0.3.

Phase Error – ≤4° rms, ≤10° peak.

RF GENERATOR 2

Frequency Range – GSM band: 935.2 to 959.8 MHz; DCS 1800 band: 1805.2 to 1879.8 MHz; PCS 1900 band (Opt. B19): 1930.2 to 1909.8 MHz.

Frequency Error – Same as time base.

Resolution – Same as channel spacing in the GSM, DCS and PCS bands.

Frequency Setting Time – ≤3 ms for phase error <2°.

Maximum Output Level – RF IN/OUT: GSM and DCS 1800 band: –37 dBm; PCS 1900 band (Opt. B19): –39 dBm; RF OUT 2: GSM and DCS 1800 band: +9 dBm; PCS 1900 band (Opt. B19): +7 dBm.

Communications Test Sets

CMD55

Resolution – 0.1 dB.

Level Error –
RF IN/OUT: ≤1.5 dB; RF OUT 2: ≤2 dB.

Harmonics RF IN/OUT – <–30 dBc.

Modulation – GMSK, B x T = 0.3.

Phase Error – ≤4° rms, ≤10° peak.

PEAK POWER METER (RF IN/OUT)
Frequency Range – GSM band: 800 to 1000 MHz; DCS 1800 band: 1700 to 1900 MHz; PCS 1900 band (Opt. B19): 1700 to 2000 MHz.

Measurement Range – GSM band – 0 to 47 dB; DCS 1800 and PCS 1900 band (Opt. B19): 0 to 33 dBm.

Resolution – 0.1 dB.

Error – GSM band: ≤0.5 dB + resolution (P > 10 dBm); DCS 1800 and PCS 1900 band (Opt. B19): ≤0.8 dB + resolution (P > 4 dBm).

VSWR – ≤1.3.

PHASE AND FREQUENCY ERROR MEASUREMENT (WITH OPT. B4)

Frequency Range – GSM band: 890.2 to 914.8 MHz; DCS 1800 band: 1710.2 to 1784.8 MHz; PCS 1900 band (Opt. B19): 1850.2 to 1909.8 MHz.

Level Range – RF IN/OUT: GSM band: 0 to 47 dBm; DCS 1800 and PCS 1900 band (Opt. B19): 0 to 33 dBm. RF IN 2: –60 to 0 dBm.

Inherent Phase Error – <1.5° rms, <5° peak.

Frequency Measurement Error – <5 Hz + time base.

BURST POWER MEASUREMENT (WITH OPT. B4)
Frequency Range – GSM band: 890.2 to 914.8 MHz; DCS 1800 band: 1717.2 to 1784.8 MHz; PCS 1900 band (Opt. B19): 1850.2 to 1909.8 MHz.

Reference Level for Full Dynamic Range – RF IN/OUT: GSM band: 10 to 47 dBm; DCS 1800 and PCS 1900 (Opt. B19): 0 to 33 dBm band. RF IN 2: GSM and DCS 1800 band: –37 to 0 dBm; PCS 1900 band (Opt. B19): –31 to 0 dBm.

Absolute Measurement Error of Peak Power – RF IN/OUT: GSM band: ≤0.5 dBm + resolution (P > 10 dBm); DCS 1800 and PCS 1900 band (Opt. B19): ≤0.8 dBm + resolution (P > 4 dBm). RF IN 2: GSM and DCS 1800 band: ≤1.3 dB; DCS 1800 and PCS 1900 band (Opt. B19): ≤1.5 dBm.

Inherent Ripple in Active Part of Time Slot – 0.1 dB.

BURST ANALYSIS WITH HIGH DYNAMIC RANGE (WITH OPT. B42)
Relative Error of Individual Test Samples – ≤1.5 dB to 72 dB below peak power.

Dynamic Range – >72 dB.

Measurement Limit – RF IN/OUT: GSM band: <–36 dBm; DCS 1800 band: <–48 dBm; PCS 1900 band (Opt. B19): <–42 dBm. RF IN 2: GSM band: <–83 dBm; DCS 1800 band: <–85 dBm.; PCS 1900 band (Opt. B19): <–79 dBm.

Reference Frequency Inputs/Outputs (with Opt. B3) –
Synchronization input – Frequency (selectable): GSM bit clock (270.8 kHz), 2, 4, 16 times GSM bit clock, 1 to 13 MHz in 1 MHz steps, 2.048, 26, 39, 52 MHz; Impedance: Approximately 100 Ω. Level: 0 dBm to TTL.

Synchronization output 1 – Frequency: 10 MHz with internal reference or frequency at synchronization input with external reference. Level: TTL, R_{out} = 50 Ω.

Synchronization output 2 – Frequency (selectable): GSM bit clock (270.8 kHz), 2, 4, 16 times GSM bit clock, 1, 2, 4, or 13 MHz; Level: TTL, R_{out} = 50 Ω.

IEC/IEEE Bus Interface (with Opt. B61) – Interface to IEC 625-1 (IEEE 488), SCPI-compatible instruction set. Opt. 04 required.

POWER REQUIREMENTS
Line Voltage – 100 to 120 V AC ±10%, 200 to 240 V AC ±10%.

Line Frequency – 50 to 400 Hz ±5%.

Power Consumption (without options) – Approximately 85 W.

ENVIRONMENTAL CHARACTERISTICS
Operating Temperature Range – 0 to 45°C to DIN IEC 68-2-1/2.

Storage Temperature Range – –40 to +60°C.

Electromagnetic Compatibility – Corresponds to requirements of European EMC guidelines (89/336/EEC).

Mechanical Resistance – Sine Vibration: DIN EIC 68-2-6, 5 to 55 Hz, amplitude 0.15 mm, two cycles; Random Vibration: DIN 40046, part 24, 10 to 300 Hz, 10 m/s², 5 minutes/axis; Shock: To MIL-STD 810 D, 400 m/s², shock spectrum in 6 main axes.

Electrical Safety – VDE 0411, Class 1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	363	14.3
Weight	**kg**	**lb.**
without options	Approx. 13.5	Approx. 29.8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CMD55
Digital Radiocommunication Tester.
Includes: Power Cord, Spare Fuses. Operating Manual.

Opt. B1 – OCXO Reference Oscillator.

Opt. B2 – HiStab OCXO Reference.

Opt. B3 – Reference Frequency Inputs/Outputs.

Opt. B4 – Fast Power Ramp, Phase/Frequency Error, and BER Measurement.

Opt. B5 – Real Time Speech Co/Decoder.

Opt. B6 – Bit Interference and TDMA Synchronization (required for Opt. B61 and B62).

Opt. B41 – Audio Measurements (Opt. B4 required).

Opt. B42 – High Dynamic Burst Analysis (Opt. B4 required).

Opt. B61 – IEC/IEEE Bus Interface (Opt. B6 required).

Opt. B62 – Memory Card Interface (Opt. B6 required).

Opt. B19 – PCS 1900 Mobile/Base Station Test.

Opt. B43 – Measurement of spectrum due to modulation and switching (requires Opt. B4 and B42).

Opt. B44 – Multitone Audio Analysis (Opt. B4, B41 required).

Opt. K43 – Narrowband Spectrum Analyzer (Opt. B4 required).

Opt. U5 – I/Q Demodulation Output and Trigger Input.

MEASUREMENT SERVICE OPTIONS
Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES – Also see page 438.

CRT-Z2 – GSM Test SIM.

Soft Carrying Case – Order CMD-Z40.

Memory Card (Opt B62 required) – Order CMDZ1.

Handset – Order CMD Z50.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

Communications Test Sets

New CMD 53

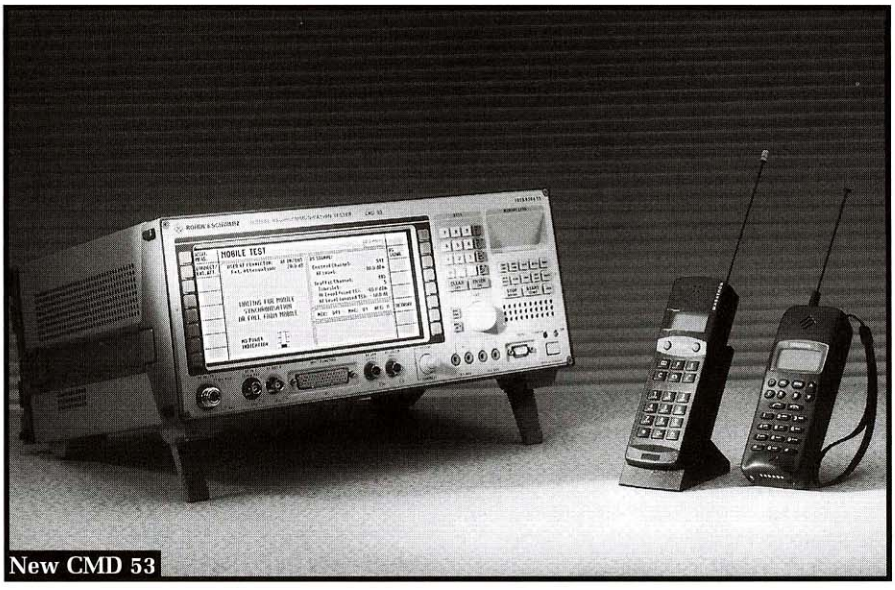
Features

CMD 53

- Compact, Versatile, Full-featured GSM/DCS/PCS 1900 Mobile Tester
- Light Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit LCD Screen with Large Characters and Simultaneous Indication of All Settings and Results
- Comprehensive Testing of Mobiles
- Powerful Signalling Capabilities
- Short Measurement Time For High Throughput
- High Measurement Accuracy
- No Specialized GSM/PCN/PCS Knowledge Required
- Service Mode for Exact Fault Location
- Autotest Provides Complete Mobile Testing at a Keystroke

Applications

- GSM Testing
- PCN (DCS 1800) Testing
- PCS (PCS 1900) Testing
- Manufacturer's Repair and Rework stations



New CMD 53

CMD 53 Digital Radiocommunication Tester

The CMD 53 Digital Radiocommunication Tester is a compact unit for testing GSM mobiles and PCN (DCS 1800) and PCS (PCS 1900) mobile phones. Range of capabilities includes all signalling, generator, and measurement functions required for verifying the correct operation of the device-under-test (DUT). The fast GO/NO-GO tests and accurate analysis make the CMD 53 ideal for service applications.

GO/NO-GO TESTING – AND MUCH MORE

The CMD 53 has been designed for use in service. Using its built-in Autotest, it carries out fast GO/NO-GO tests on all parts of the mobile unit. If a DUT is known to be defective, the CMD 53 provides a large variety of measuring troubleshooting facilities for locating the problem. In the service mode, the CMD 53 can replace a complete test lab.

EASY TO USE BY BOTH BEGINNERS AND EXPERTS

High measurement accuracy and comprehensive signalling capabilities are normally found only in instruments that are difficult to operate. But not with the CMD 53. Even with all its power, the CMD 53 is easy to use, even by personnel who have no special knowledge of the new digital networks. A large LCD display with graphics capability and softkey menus provide easy operation. With a few keystrokes, you can completely check out a mobile.

TEST ALL THE MAJOR FUNCTIONS

The CMD 53 provides the following major test functions:

- Mobile synchronization
- Location update
- Incoming call setup
- Outgoing call setup
- Mobile power level control
- Handover (channel change, time-slot change)
- Peak power measurement
- SACCH measurement (e.g., RxLev, RxQual, power level)
- Echot test
- Call clearing by mobile
- Call clearing by CMD
- DC current/voltage measurements (Opt. B20)
- Phase and frequency error measurements (Opt. B4)
- Measurement of power ramping as a function of time (Opt. B4)
- Bit-error rate (BER) measurement (Opt. B4)

Characteristics

TIME BASE

Time Base TCXO (standard) –

Nominal Frequency: 10 MHz.
Frequency Drift (0°C to 50°C): ≤1.5 x 10^{-6}.
Aging (at 35°C): ≤0.5 x 10^{-6}/year.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New CMD 53

Time Base OCXO (with Opt. B1) –
Nominal Frequency: 10 MHz.
Frequency Drift (0 C to 50°C): ≤1 x 10^{-7}.
Aging: ≤2 x 10^{-7}/year, ≤5 x 10^{-9}/day after 30 days of operation.
Warmup Time (at 25°C): Approximately 5 minutes.

DC Voltmeter (with Opt. B20) –
Measurement Range: 0 to ±30 V.
Resolution: 10 mV.
Error: ≤2% + resolution.

DC Ammeter (with Opt. B20) –
Operating Modes: Current averaging with GSM-adapted time constant, current peak measurement (maximum and minimum).
Measurement Range: 0 to ±10 A.
Common-mode Rejection: ±30 V.
Resistance: 50 mΩ.
Resolution for Current Averaging: 1 mA/10 mA.
Resolution for Peak Measurement: 10 mA.
Residual Indication (no current at input, at room temperature): ≤10 mA.
Error: ≤2% + residual indication + resolution.

AF MEASUREMENT UNIT (WITH OPTION B41)

AF Generator –
Frequency:
- Range: 50 Hz to 10 kHz.
- Resolution: 0.1 Hz.
- Error: Same as time base + half resolution.

Level:
- Range: 10 µV to 5 V.
- Resolution:
  - Voltage <1 mV: 10 µV.
  - Voltage ≥1 mV: 1%.
- Error: ≤5% at voltage ≥1 mV.

Distortion: <0.5%.
Maximum Output Current: 20 mA.
Output Impedance: 1 MΩ.

AF Voltmeter –
Frequency Range: 50 Hz to 10 kHz.
Measurement Range: 0.1 mV to 30 V.
Resolution:
- Voltage <10 mV: 100 µV.
- Voltage ≥10 mV: 1%.

Error: ≤5% + resolution.
Input Impedance: 1 MΩ.

Distortion Meter –
Frequency Range: 300 Hz to 3 kHz.
Input Level Range: 100 mV to 30 V.
Resolution: 0.1% distortion.
Inherent Distortion: ≤0.5%.
Error: ≤5% + inherent distortion.
Measurement Bandwidth: 10 kHz.

AF Counter –
Frequency Range: 20 Hz to 10 kHz.
Input Level Range: 10 mV to 30 V.
Resolution: ≤1 Hz.
Error: Same as reference + resolution.
Input Impedance: 1 MΩ.

IF Counter –
Frequency Range: 10 Hz to 60 MHz.
Input Level Range: 100 mV_{RMS} to TTL.
Resolution: 1 Hz.
Error: Same as reference + resolution.
Input Impedance: 1 MΩ, 100 pF.

RF GENERATOR 1

Frequency Range –
GSM: 935.2 to 959.8 MHz.
DCS 1800: 1805.2 to 1879.8 MHz.
DCS 19001: 1930.2 to 1989.8 MHz.

Frequency Error – Same as time base.

Resolution – GSM channel spacing: 200 kHz.

Frequency Setting Time – ≤3 ms for phase error <2°.

Output Level (RF IN/OUT) – –35/–37*1 to –120 dBm.

Output Level (OUTPUT 2) – +11/+9*1 to –77 dBm*2.

Resolution – 0.1 dB.

Level Error (RF IN/OUT) – ≤1.5 dB (≤1 dB at –104 dBm).

Level Error (OUTPUT 2) – ≤2 dB*2.

Harmonics (RF IN/OUT) – <–30 dBc.

Modulation – GMSK, B x T = 0.3.

Phase Error – ≤4° RMS, ≤10° peak.

RF GENERATOR 2

Frequency Range, Frequency Error, Resolution, Setting Time, Level, Resolution, Harmonics, Modulation, Phase Error – See RF Generator 1.

Maximum Output Level –
RF IN/OUT: –37/–39*1 dBm.
RF OUT 2: +9/+7*1 dBm*2.

Level Error –
RF IN/OUT: ≤1.5 dB.
RF OUT 2: ≤2 dB*2.

PEAK POWER METER (RF IN/OUT)

Frequency Range –
800 to 1000 MHz.
1700 to 2000 MHz.

Measurement Range –
GSM Band: 0 to 47 dBm.
DCS 1800/1900 Band: 0 to 33 dBm.

Resolution – 0.1 dB.

Error in GSM Band – <0.5 dB + resolution (P >10 dBm).

Error in DCS 1800/1900 Band – <0.8 dB + resolution (P >4 dBm).

VSWR – ≤1.3.

PHASE AND FREQUENCY ERROR MEASUREMENT (WITH OPTION B4)

Frequency Range –
GSM: 890.2 to 914.8 MHz.
DCS 1800: 1710.2 to 1784.8 MHz.
PCS 1900*1: 1850.2 to 1909.8 MHz.

Level Range –
RF IN/OUT:
- GSM: 0 to 47 dBm.
- DCS 1800/1900: 0 to 33 dBm.

RF IN 2: –60/–541 to 0 dBm2.
Inherent Phase Error: <1.5° RMS, <5° peak.
Frequency Measurement Error: <5 Hz + time base.

BURST POWER MEASUREMENT (WITH OPTION B4)

Frequency Range –
GSM: 890.2 to 914.8 MHz.
DCS 1800: 1717.2 to 1784.8 MHz.
PCS 1900*1: 1850.2 to 1909.8 MHz.

Reference Level for Full Dynamic Range –
RF IN/OUT:
- GSM: 10 to 47 dBm.
- DCS 1800/1900: 0 to 33 dBm.

RF IN 2: –37/–311 to 0 dBm*2.

Absolute Measurement Error of Peak Power –
RF IN/OUT:
- GSM: ≤0.5 dB + resolution (P >10 dBm).
- DCS 1800/1900: ≤0.8 dB + resolution (P >4 dBm).

RF IN*2:
- GSM: ≤1.3 dB*2.
- DCS 1800/1900: ≤1.5 dB.

Resolution in Active Part of Time Slot – 0.1 dB.

BURST ANALYSIS WITH HIGH DYNAMIC RANGE (WITH OPTION B42)

Relative Error of Individual Test Samples – ≤1.5 dB to 72 dB below peak power.

Dynamic Range – >72 dB.

Measurement Limit –
RF IN/OUT:
- GSM: <–36 dBm.
- DCS 1800: <–48 dBm.
- PCS 1900*1: <–42 dBm.

RF IN 2:
- GSM: <–83 dBm*2.
- DCS 1800: <–85 dBm*2.
- PCS 1900*1: <–79 dBm*2.

*1 *In PCS 1900 made with Opt. B19.*
*2 *Only with Opt. B30.*

Communications Test Sets

New CMD 53

GSM-SPECIFIC SPECTRUM MEASUREMENTS (WITH OPTION B43)

Spectrum Due to Modulation –
Test Method: Relative measurement, averaging.
Filter Bandwidth: 30 kHz 5-pole resolution filter, 30 kHz video filter.
Measurement Offset: 100, 200, 250, 400, 600, 800, 1000, 1200, 1400, 1600, and 1800 kHz.
Dynamic Range (better than required by GSM specification):
With offset >400 kHz: 80 dB maximum.
Error: ≤1.5 dB.

Spectrum Due to Switching –
Test Method: Absolute measurement, Max Hold over several measurements.
Filter Bandwidth: 30 kHz 5-pole resolution filter, 100 kHz video filter.
Measurement Offset: 400, 600, 1200, 1800 kHz.
Dynamic Range (better than required by GSM specification):
With offset >400 kHz: 80 dB maximum with SW correction, 76 dB maximum without SW correction.
Error:
Dynamic Range <50 dBc: ≤1.5 dB.
Dynamic Range <50 to 80 dBc: ≤2.5 dB.

NARROWBAND SPECTRUM ANALYZER (OPT. K43 – OPT. B4 REQUIRED)

Frequency Range – Same as basic instrument.

Frequency Span – ±150 kHz.

Resolution Bandwidth – 4/10/20/50 or 100 Hz.

Operating Modes – CW or burst.

Averaging – 1/2/5/10/20/50 or Max Hold.

Markers – Delta frequency, delta level, and absolute level.

INTERFACES

Remote Printer –
RS-232C: 9-contact.
Centronics: 25-contact.

Reference Frequency Inputs/Outputs (Option B3) –
Synchronization Input:
Frequency (selectable): GSM bit clock (270.8 kHz), 2/4/16 times GSM bit clock, 1 to 13 MHz in 1-MHz steps, 2.048, 26, 39, 52 MHz.
Impedance: Approx. 100 Ω.
Level: 0 dBm to TTL.
Synchronization Output 1:
Frequency: 10 MHz with internal reference or frequency at synchronization input with external reference.
Level: TTL, R_{OUT} = 50 Ω.
Synchronization Output 2:
Frequency (selectable): GSM bit clock, 2/4/16 times GSM bit clock, 1, 2, 4, or 13 MHz.
Level: TTL, R_{OUT} = 50 Ω.

GENERAL

Temperature –
Operating: 0°C to +45°C (to DIN IEC 68-1/2).
Storage: –40°C to +60°C.

Mechanical –
Sine Vibration: DIN IEC 68-2-6, 5 to 55 Hz, amplitude 0.15 mm, two cycles.
Random Vibration: DIN 40046, part 24, 10 to 300 Hz, 10 m/s^2 RMS, 5 min/axis.
Shock: To MIL-STD-810 D, 400 ms/s^2, shock spectrum in 6 main axes.
Electromagnetic Compatibility – Corresponds to requirements of European EMC directive (89/336/EEC).

Electrical Safety – VDE 0411, class 1.

POWER

Line Voltage –
100 to 120 VAC, ±10%.
200 to 240 VAC, ±10%.

Line Frequency – 50 to 400 Hz, ±5%.

Power Consumption (without options) – Approx. 95 W.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	363	14.3
Weight	**kg**	**lb.**
Without Options	14	30.8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CMD 53
Digital Radiocommunication Tester
Includes: Power Cord, Operating Manual, Spare Fuses.

OPTIONS

Opt. B1 – OCXO 1.5 x 10^{-6} Reference Oscillator.

Opt. B3 – Reference Frequency Inputs/Outputs.

Opt. B4 – Fast Power Ramp, Phase/Frequency Error, and BER Measurements.

Opt. B6 – TDMA Signals and Adapter for Other Options.

Opt. B19 – PCS 1900 BTS Testing.

Opt. B20 – GSM Voltage and Current Measurement.

Opt. B30 – High-level RF Input/Output.

Opt. B41 – AF Measurement with Frequency Counter (Opt. B4 required).

Opt. B42 – High Dynamic Burst Analysis (Opt. B4 required).

Opt. B43 – GSM/PCN Spectrum Measurement (Opt. B4 and B42 required).

Opt. B44 – Multitone Audio Analysis Software (Opt. B4, B41, U10 required).

Opt. B62 – Memory Card Interface (Opt. B6 required).

Opt. K43 – Narrowband Spectrum Analyzer Software (Opt. B4 required).

Opt. U5 – I/Q Demodulation Output and Trigger Input.

Opt. U10 – 8 MB RAM.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES

Soft Carrying Case – Order CMD-Z40.
Memory Card (Opt. B62 required) – Order CMDZ1.
GSM Test SIM – Order CRT-Z2.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New CTS 55

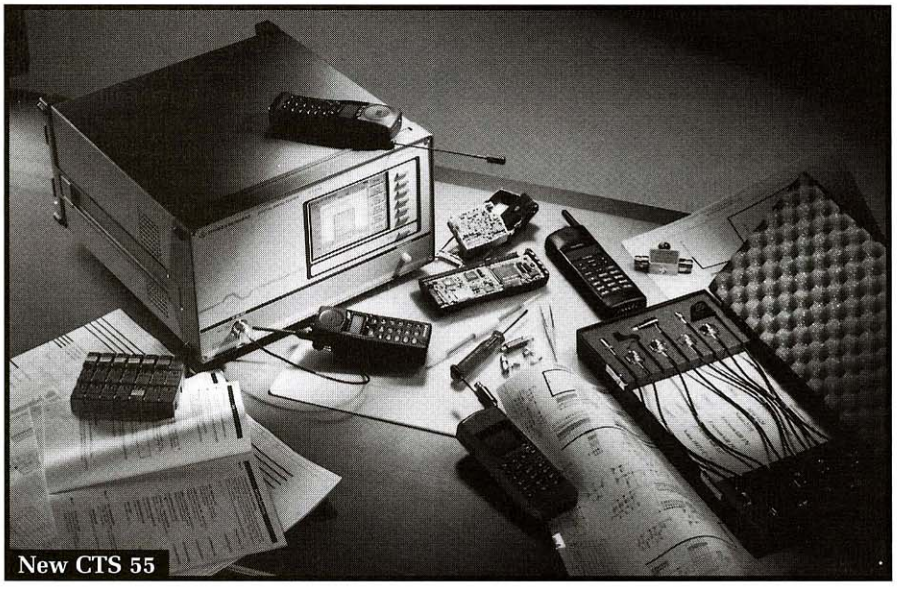
Features

CTS 55

- Screen, Diagnose, and Facilitate Repair of GSM/PCS 1900 Mobiles
- Light Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit Color TFT Screen
- Comprehensive Mobile Phone Testing
- High Measurement Accuracy
- No Specialized Knowledge Required

Applications

- Mobile Phone Testing
- Network Operator Repair Centers
- Independent Dealerships
- Central Repair Deports


New CTS 55

CTS 55 Digital Radio Tester

The CTS 55 Digital Radio Tester is a compact unit for testing GSM, DCS 1800, and PCS 1900 mobile phones. It combines ease of use with the necessary test depth for all areas of service.

DETAILED GSM/DCS KNOWLEDGE NOT REQUIRED

The CTS 55 is extremely easy to use and requires no detailed GSM or DCS knowledge to make accurate measurements. Both the newcomer and experienced service specialist will be able to carry out manual or automatic measurements.

THREE STEPS TO REPAIR

With an ideal combination of Quick, Auto, and Manual Test, the CTS 55 caters to all steps in the process. Quick Test allows the operator to quickly check the true status of returned phones, thus screening out good phones from further testing. Auto Test provides for fast diagnosis of the faulty parameter. Manual Test allows the operator to concentrate on a particular parameter during the repair phase.

ALL THE NEEDED MEASUREMENTS

The CTS provides the following measurement and test functions:

- Call setup and cleardown (incoming and outgoing)
- Free selection of channels
- Power and channel change
- Echo test
- Power measurement
- Receiver sensitivity test through bit error rate measurement as well as RxLev and RxQual
- Phase and frequency error
- Power ramp vs.

HIGH-RESOLUTION COLOR DISPLAY

The TFT color LCD display provides a bright, clear display of measurements, even under high ambient lighting. Colored menus and highlighting of important events such as out-of-tolerance conditions.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New CTS 55

Characteristics

Reference Oscillator –
Frequency Drift (+5° C to +40° C): ≤1 ppm.
Aging (at 35° C: ≤0.5 ppm/year.

OCXO Reference Oscillator (with Opt. B1) –
Frequency Drift (+5° C to +40° C): ≤0.1 ppm.
Aging (at 35° C: ≤0.2 ppm/year.

RF Generator –
Frequency Range:
GSM: 935 to 960 MHz.
DCS 1800: 1805 to 1880.
PCS 1900: 1930 to 1990 MHz.
Resolution:
GSM/DCS channel spacing: 200 kHz.
Output Level:
0 dB Ext. Atten.: –50 to –110 dBm.
15 dB Ext. Atten.: –65 to –110 dBm.
Level Error: ≤1.5 dB.
Modulation: GMSK, B x T = 0.3.

Peak Power Meter –
Frequency Range:
GSM: 890 to 915 MHz.
DCS 1800: 1710 to 1785 MHz.
PCS 1900: 1850 to 1910 MHz.
Measurement Range
0 dB Ext. Atten.: –15 to +39 dBm (peak values up to 41 dBm).
15 dB Ext. Atten.: 0 to +39 dBm (peak values up to 41 dBm).
Resolution: 0.1 dB.
Error:
0 dB Ext. Atten. P >5 dBm: ≤1 dB.
–5 dBm < P ≤5 dBm: ≤1.5 dB.
–15 dBm < P ≤ 5 dBm: ≤2 dB.

Phase and Frequency Error Measurement –
Frequency Range:
GSM: 890 to 915 MHz.
DCS 1800: 1710 to 1785 MHz.
PCS 1900: 1850 to 1910 MHz.
Level Range:
–15 to +39 dBm (peak values up to 41 dBm.
Inherent Phase Error:
GSM: <1.4° RMS, <4.5° peak.
DCS 1800: <2.0° RMS, <5.5° peak.
PCS 1900: <2.2° RMS, <6.0° peak.
Frequency Measurement Error: <15 Hz + base.

Burst Power Measurement –
Frequency Range:
GSM: 890 to 915 MHz.
DCS 1800: 1710 to 1785 MHz.
PCS 1900: 1850 to 1910 MHz.
Reference Level for Full Dynamic Range:
0 to +39 dBm (peak values up to 41 dBm.
Total Error of Peak Power Measurement (P > 0 dBm): ≤1.5 dB + resolution.
Resolution: 0.1 dB.

VSWR (RF IN/OUT) – ≤1.5.

ENVIRONMENTAL
Temperature –
Operating: +5° C to +40° C.
Storage: –25° C to +60° C.

Humidity – IEC 68-2-3.

Mechanical –
Sine Vibration: IEC 68-2-6,IEC 1010-1, MIL-T-28800 D class 5.
Random Vibration: DIN 40046.
Shock: MIL-STD-810 D, MIL-T-28800 D classes 3 and 5.

Electromagnetic Compatibility –
Complies with European EMC directives EN 50081-1 and EN 50082-1.

Electrical Safety – ENG 1010-1, IEC 1010-1.

POWER
Line Voltage –
100 to 120 VAC, ±10%.
200 to 240 VAC, ±10%.

Line Frequency – 50 to 60 Hz, ±5%.

Power Consumption – Approx. 50 W.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	177	7
Width	319	12.6
Depth	350	13.8
Weight	**kg**	**lb.**
Without Options	7.8	17.2

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CTS 55
Digital Radio Tester.
Includes: Power Cord, Operating Manual.

CTS 55 OPTIONS
Opt. B1 – OCXO 2 x 10^{-7}/year Reference Oscillator.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
GSM Test SIM – Order CRT-Z2.
Standard PC Keyboard – Order PSA-Z2.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New CTD 55

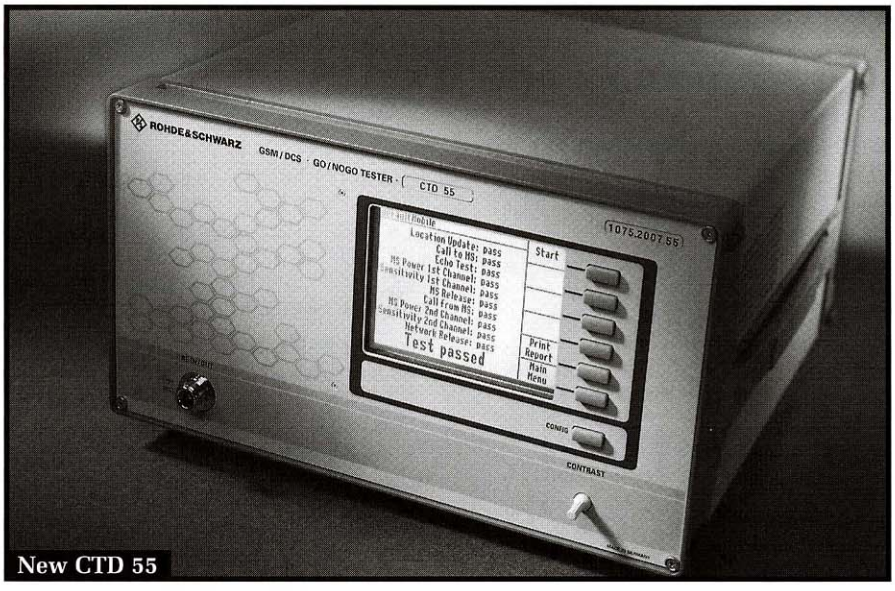
Features

CTD 55

- Light Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit LCD Screen
- GO/NO-GO Testing
- High Measurement Accuracy
- No Specialized GSM/DCS Knowledge Required
- Auto and Step Test Modes
- Results Printout Option for Test Reports

Applications

- GSM Testing
- DCS 1800 Testing
- PCS 1900 Testing
- Point-of-Sale Testing
- Incoming Inspection Testing



New CTD 55

CTD 55 Digital Radiocommunication Tester

The CTD 55 GSM/DCS GO/NO-GO Tester is a compact unit for testing GSM, DCS 1800, and PCS 1900 mobile phones. The tests run automatically. A clear GO/NO-GO indication gives instant indication of results.

EASY TO USE BY BOTH BEGINNERS AND EXPERTS

The CTD 55 combines high measurement accuracy with ease-of-use. No specialized knowledge of mobile radio testing is required for basic operation.

THE MEASUREMENT FUNCTIONS YOU NEED

- Location update – simulates a base station
- Call setup – incoming/outgoing
- Control of Mobile transmit power
- Measure peak power
- Measure sensitivity through evaluation of:
  - Reception quality (RxQual)
  - Reception level (RxLev)
- Echo test for fast, comprehensive GO/NO-GO decision
- Function test of numeric keypad with called number display
- Printout of IMSI/IMEI on test log:
  - IMSI for identification of network data (SIM Card)
  - IMEI for identification of phone
- Channel change
- Measurements made on freely selectable GSM/DCS/PCS channels

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New CTD 55

Characteristics

RF GENERATOR

Frequency Range –
GSM: 935 to 960 MHz.
DCS 1800: 1805 to 1880 MHz.
PCS 1900: 1930 to 1990 MHz.

Frequency Drift (+5° C to +40° C) – ≤1ppm.

Aging (at 35° C) – ≤0.5 ppm/year.

Resolution – GSM channel spacing: 200 kHz.

Output Level –
0 dB Ext. Atten.: –50 to –110 dBm.
15 dB Ext. Atten.: –65 to –110 dBm.

Level Error – ≤1.5 dB.

Modulation – GMSK, B x T = 0.3.

PEAK POWER METER

Frequency Range –
GSM: 890 to 915 MHz.
DCS 1800: 1710 to 1785 MHz.
PCS 1900: 1850 to 1910 MHz.

Measurement Range –
0 dB Ext. Atten.:
Pulsed operation 1:8: –15 to +45 dBm.
CW: –15 to +39 dBm.
15 dB Ext. Atten.:
Pulsed operation 1:8: 0 to +45 dBm.
CW: 0 to +39/45 dBm.

Resolution – 0.1 dB.

Error at 0 dB Ext Atten. –
P > +5 dBm: ≤1 dB.
–5 dBm <P ≤ +5 dBm: ≤1.5 dB.
–15 dBm < P ≤ –5 dBm: ≤2 dB.

ENVIRONMENTAL

Temperature –
Operating: +5° C to +40° C.
Storage: –40° C to +60° C.

Humidity – IEC 68-2-3.

Mechanical –
Sine Vibration: IEC 68-2-6, IEC 1010-1, MIL-T-28800 class 5.
Random Vibration: DIN 40046.
Shock: MIL-STD-810 D, MIL-T-28800D classes 3 and 5.

Electromagnetic Compatibility – Complies to requirements of European EMC directive EN 50081-1 and EN EN50082-1.

Electrical Safety – VDE 0411, class 1.

POWER

Line Voltage –
100 to 120 VAC, ±10%.
200 to 240 VAC, ±10%.

Line Frequency – 50 to 60 Hz, ±5%.

Power Consumption – 50 W maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	177	7
Width	319	12.6
Depth	300	11.8
Weight	**kg**	**lb.**
Net (approx.)	7.3	16.1

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CTD 55
GSM/DCS GO/NO-GO Tester
Includes: Power Cord, Operating Manual, Spare Fuses.

CTD 55 OPTIONS
Opt. B5 – Enhanced Analysis with Test Report via Centronics Interface (25-Pin connector).

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
GSM Test SIM – Order CRT-Z2.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New CMD 59

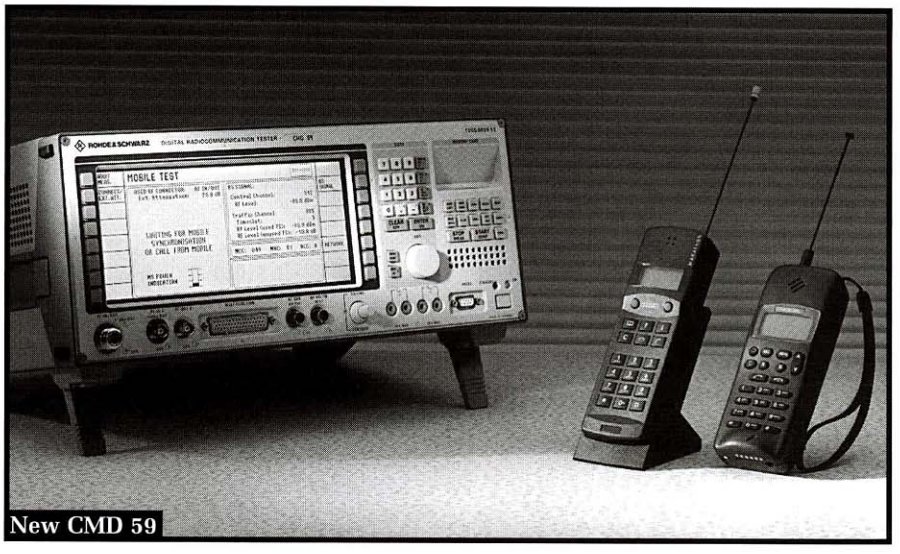
Features

CMD 59

- Compact, Versatile, Full-featured PCS 1900 Base Station Tester
- Light Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit LCD Screen with Large Characters and Simultaneous Indication of All Settings and Results
- Comprehensive Base Station Testing
- Short Measurement Time For High Throughput
- High Measurement Accuracy
- In-service Testing Option
- A_{bis} Control Options Available
- Remote Control via IEC/IEEE Bus (Optional)

Applications

- Production Testing
- Final Testing with A_{bis} Control (optional)
- Installation with A_{bis} Control (optional)
- In-service Testing with Test Mobile Functionality (Optional)



New CMD 59

CMD 59 Digital Radiocommunication Tester

The CMD 59 Digital Radiocommunication Tester is a compact unit for testing PCS (PCS 1900) base stations (BTS) and BTS modules. It allows measurements on base station transmitters and receivers without affecting calls in progress. With the in-service test option, measurements can be made without taking a cell site out of service.

DETAILED PCS KNOWLEDGE NOT REQUIRED
The CMD 59 is easy to use and is equally at home in production, installation, and service environments. Ease of use goes beyond the front panel. All parameters can be individually modified in the configuration menus to allow easy adaptation to stringent user-specific tolerances. Any parameters that have modified with respect to the default standard specifications are clearly shown on the display.

Additional attenuators, cables, and amplifiers are often required for connecting to the BTS. The effect of these additions are taken into account by the CMD 59 when calculating the measurement results.

TEST YOUR TRANSMITTER...
The following PCS-specific measurements are available for transmitter testing:

- Mean RF carrier power
- Power ramping
- Phase/frequency error
- Spectrum due to modulation
- Spectrum due to switching

Measurement results on the transmitter's traffic channel (TCH) are obtained by simply switching to the corresponding menu. The results are graphically displayed along with applicable statistical functions.

...AND RECEIVERS TOO!
You can also make the required tests on receivers:

- Bit error rate (BER)
- Adjacent time slot rejection

PLUS MANY OTHER MEASUREMENTS
You can also make may other base station measurements with the CMD 59 including:

- Echo test
- Module tests without signalling or time synchronization
- Alignment using built-in multifunction RF generator
- AF measurements with optional frequency counter

Characteristics

TIME BASE

Time Base TCXO (standard) –
Nominal Frequency: 10 MHz.
Frequency Drift (0°C to 35°C): ≤1.5 x 10^{-6}.
Aging (at 35°C): ≤0.5 x 10^{-6}/year.

Time Base OCXO (with Opt. B1) –
Nominal Frequency: 10 MHz.
Frequency Drift (0°C to 50°C): ≤1 x 10^{-7}.
Aging: ≤2 x 10^{-7}/year, ≤5 x 10^{-9}/day after 30 days of operation.
Warmup Time (at 25°C): Approx. 5 minutes.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2 with SCPI conformance.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

New CMD 59

Time Base OCXO (with Opt. B2) –
Nominal Frequency: 10 MHz.
Frequency Drift (0°C to 50°C):
Referenced to 25°C: ≤5 x 10^{-9}.
Instrument turned by 90° (at 25°C): ≤1 x 10^{-8}.
After 2 hr warm-up at 25°C after 24 hr out-of service: ≤5 x 10^{-9}.
Aging: ≤3.5 x 10^{-8}/year, ≤5 x 10^{-10}/day after 30 days of operation.
Warmup Time (at 25°C): Approx. 10 minutes.

AF MEASUREMENT UNIT (OPT. B41)
AF Generator –
Frequency:
Range: 50 Hz to 10 kHz.
Resolution: 0.1 Hz.
Error: Same as time base + half resolution.
Level:
Range: 10 µV to 5 V.
Resolution:
Voltage <1 mV: 10 µV.
Voltage ≥1 mV: ≤1%.
Error: ≤5% at voltage ≥1 mV.
Distortion: <0.5%.
Maximum Output Current: 20 mA.
Output Impedance: <5 Ω.

AF Voltmeter –
Frequency Range: 50 Hz to 10 kHz.
Measurement Range: 0.1 mV to 30 V.
Resolution:
Voltage <10 mV: 100 µV.
Voltage ≥10 mV: 1%.
Error: ≤5% + resolution.
Input Impedance: 1 MΩ.

Distortion Meter –
Frequency Range: 300 Hz to 3 kHz.
Input Level Range: 100 mV to 30 V.
Resolution: 0.1% of THD.
Inherent Distortion: ≤0.5%.
Error: ≤5% + inherent distortion.
Measurement Bandwidth: 10 kHz.

AF Counter –
Frequency Range: 20 Hz to 10 kHz.
Input Level Range: 10 mV to 30 V.
Resolution: ≤1 Hz.
Error: Same as reference + resolution.
Input Impedance: 1 MΩ.

IF Counter –
Frequency Range: 10 kHz to 60 MHz.
Input Level Range: 100 mV_{RMS} to TTL.
Resolution: 1 Hz.
Error: Same as reference + resolution.
Input Impedance: 1 MΩ, 100 pF.

RF GENERATOR
Frequency Range –
PCS 1900: 1850.2 to 1909.8 MHz.

Frequency Accuracy – Same as time base.

Resolution – PCS channel spacing: 200 kHz.

Settling Time – ≤3 ms for phase error <2°.

Output Level (RF IN/OUT/OUTPUT 2) – –37 to –120 dBm.

Resolution – 0.1 dB.

Level Error (RF IN/OUT/OUTPUT 2) – ≤1.5 dB (≤1 dB at 104 dBm).

Harmonics (RF IN/OUT) – <–30 dBc.

Modulation – GMSK, B x T = 0.3.

Phase Error – ≤4° RMS, ≤10° peak.

PEAK POWER METER (RF IN/OUT)
Measurement Range – 0 to 47 dBm.

Maximum RF Power –
Pulsed: 47 dBm.
CW: 45 dBm.
CW at Room Temperature: 47 dBm.

Resolution – 0.1 dB.

Error in PCS 1900 Band (1930.2 to 1989.8 MHz) – <0.8 dB + resolution (P >4 dBm).

VSWR – ≤1.3.

PHASE AND FREQUENCY ERROR MEASUREMENT
Frequency Range –
PCS 1900: 1930.2 to 1989.8 MHz.

Level Range –
RF IN/OUT: 0 to 47 dBm.
RF IN 2: –51 to 0 dBm.
Inherent Phase Error: <1.5° RMS, <5° peak.
Frequency Measurement Error: <5 Hz + time base.

BURST POWER MEASUREMENT
Frequency Range –
PCS 1900: 1930.2 to 1989.8 MHz.

Reference Level for Full Dynamic Range –
RF IN/OUT: PCS 1900: 0 to 47 dBm.
RF IN 2: –31 to 0 dBm.

Absolute Measurement Error of Peak Power –
RF IN/OUT:
Unsynchronized: Same as peak power meter.
Synchronized to C0 carrier: ≤1.5 dB.
RF IN 2: ≤1.5 dB.

Resolution in Active Part of Time Slot – ≤0.1 dB.

HIGH-DYNAMIC BURST ANALYSIS
Relative Error of Individual Test Samples – ≤1.5 dB to 72 dB below peak power.

Dynamic Range – >72 dB.

Measurement Limit –
RF IN/OUT: <–42 dBm.
RF IN 2: <–79 dBm.

PCS-SPECIFIC SPECTRUM MEASUREMENTS
Spectrum Due to Modulation –
Test Method: Absolute measurement, averaging.
Resolution Filter Bandwidth: 30 kHz.
Measurement Offset: 100, 200, 250, 400, 600, 800, 1000, 1200, 1400, 1600, and 1800 kHz.
Dynamic Range (better than required by PCS 1900 specification):
For offset >400 kHz: 80 dB maximum.
Error: ≤1.5 dB.

Spectrum Due to Switching –
Test Method: Relative measurement, Max Hold over several measurements.
Resolution Filter Bandwidth: 30 kHz.
Measurement Offset: 400, 600, 1200, 1800 kHz.
Dynamic Range (better than required by PCS 1900 specification):
With offset >400 kHz: 80 dB maximum with SW correction, 76 dB maximum without SW correction.
Error:
Dynamic Range <50 dBc: ≤1.5 dB.
Dynamic Range 50 to 80 dBc: ≤2.5 dB.

MULTICARRIER MODE (OPTION B8)
Following specifications apply to all cases in which interfering carriers (up to 30 dB above useful level) are more than 30 channels away. If there are interfering signals close to the useful carrier, an additional IF filter is switched in (multicarrier mode).

Typical Filter Characteristics in Multicarrier Mode (this filter increases the measurement error for phase and power measurements; see below) –

Offset from Useful Channel	Filter Suppression
0 kHz	0 dB (reference)
200 kHz	<3 dB
400 kHz	>20 dB
600 kHz	>33 dB
800 kHz	>41 dB
1000 kHz	>48 dB

Phase and Frequency Error Measurement –
Inherent Phase Error: ≤2° RMS, ≤7.5° peak.

Measurement of Peak Power/Burst Power –
Level Error: ≤1.5 dB.

Communications Test Sets

New CMD 59

PCS 1900 Specific Spectrum Measurements – The dynamic range specified for the basic model refers to the sum of all input voltage components. The additional carriers appear as strong spurious emissions in the spectrum measurement and have to be taken into account accordingly when evaluating the tolerances.

For additional detail on the Multicarrier Mode, refer to the CMD 59 data sheet.

INPUT/OUTPUT
Interfaces –
RS-232C: 9-contact.
Centronics: 25-contact.

Reference Frequency Inputs/Outputs (Option B3) –
Synchronization Input:
Frequency (selectable): Bit clock (270.8 kHz), 2/4/16 times PCS bit clock, 1 to 13 MHz in 1 MHz steps, 2.048/16.384/26/39/52 MHz.
Impedance: Approx. 100 Ω.
Level: 0 dBm to TTL.
Synchronization Output 1:
Frequency: 10 MHz with internal reference or frequency at synchronization input with external reference.
Level: TTL, R_{OUT} = 50 Ω.
Synchronization Output 2:
Frequency (selectable): Bit clock, 2/4/16 times PCS bit clock, 1/2/4/13 MHz.
Level: TTL, R_{OUT} = 50 Ω.

A_{bis} Interface (Option B7) –
Receive Channel (traffic/speech):
Unbalanced: 75 Ω/high impedance.
Balanced: 120 Ω/high impedance.
Time slot (selectable): 16 kbit/s.
Protocol: E1/T1.

GENERAL
Temperature –
Operating: 0°C to +45°C (to DIN IEC 68-1/2).
Storage: –40°C to +60°C.

Mechanical –
Sine Vibration: DIN IEC 68-2-6, 5 to 55 Hz, amplitude 0.15 mm, two cycles.
Random Vibration: DIN 40046, part 24, 10 to 300 Hz, 10 m/s2 RMS, 5 min/axis.
Shock: To MIL-STD-810 D, 400 ms/s^2, shock spectrum in 6 main axes.

Electromagnetic Compatibility –
Corresponds to requirements of European EMC directive (89/336/EEC).

Electrical Safety – VDE 0411, class 1.

POWER
Line Voltage –
100 to 120 VAC, ±10%.
200 to 240 VAC, ±10%.

Line Frequency – 50 to 400 Hz, ±5%.

Power Consumption (without options) –
Approx. 85 W.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	363	14.3
Weight	**kg**	**lb.**
Without Options	15	33

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CMD 59
Digital Radiocommunication Tester.
Includes: Power Cord, Operating Manual, Spare Fuses.

CMD 59 OPTIONS
Opt. B1 – OCXO 1.5 x 10^{-6} Reference Oscillator.
Opt. B2 – OCXO 1.5 x 10^{-7} Reference Oscillator.
Opt. B3 – Reference Frequency Inputs/Outputs.
Opt. B5 – Real Time Speech Coder/Decoder.
Opt. B6 – Adapter for Other Options.
Opt. B7 – A_{bis} interface E1 and T1 (ver 6); includes 64 and 16 kbit signalling.
Opt. B8 – In Service Testing (Opt. B6 required).
Opt. B41 – AF Measurement with Frequency Counter.
Opt. B61 – IEEE 488 Bus Interface (Opt. B6 required).
Opt. B62 – Memory Card Interface (Opt. B6 required).
Opt. K10 – Ericsson A_{bis} Control Software (RBS2000, RBS200).
Opt. K11 – Nokia A_{bis} Control Software (DE21, DE34, DE45).
Opt. K13 – NMC A_{bis} Control Software (S2000, S4000).
Opt. K14 – Siemens A_{bis} Control Software (BS20, BS60).
Opt. K30 – Signaling Software for MOC/MTC.
Opt. K43 – Narrowband Spectrum Analyzer Software.
Opt. K51 – Ciphering Software.
Opt. U3 – 11 dBm Second RF Output (9 dBm).

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Soft Carrying Case – Order CMD-Z40.
Handset – Order CMD-Z50.
Memory Card (Opt. B62 required) – Order CMDZ1.
Transit Case – Order ZZK-014.
Nortel A_{bis} Cable (2 meter) – Order CMD-Z20.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2 with SCPI conformance.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets

CMD57

Features

CMD57

- Complete Range of Transmitter and Receiver Measurements
- Large Illuminated LCD Display for Fast Reading of Parameters and Measured Values
- Menu-guided User Interface for Quick Tests as Well as for In-depth Analysis
- Softkey Control with Display of All the Important Parameters Enabling Operator to Work Error-free
- Extremely Short Setting and Measuring for Both Manual and Remote Control via IEEE Bus
- A_{bis} Control Options Available
- In-service Testing Option

Applications

- GSM 900, DCS 1800, and PCS 1900 Base Station Measurements
- Manufacturing, Installation, and Maintenance

CMD57

CMD 57 Digital Radiocommunication Tester

The CMD 57 Digital Radiocommunication Tester is a compact unit for testing GSM, DCS 1800 and PCS 1900 base stations (BTS) and BTS modules. It allows measurements on base station transmitters and receivers without affecting calls in progress. With the in-service test option, measurements can be made without taking a cell site out of service.

DETAILED KNOWLEDGE NOT REQUIRED

The CMD 57 is easy to use and is equally at home in production, installation and service environments. Ease of use goes beyond the front panel. All parameters can be individually modified in the configuration menu to allow easy adaption to stringent user-specific tolerances. Any parameters that have modified with respect ot the default standard specifications are clearly shown on the display.

Additional attenuators, cables, and amplifiers are often required for connecting to the BTS. The effect of these additions are taken into account by the CMD 57 when calculating the measurement results.

TEST YOUR TRANSMITTER

The following GSM/DCS/PCS specific measurements are available for transmitter testing:

- Mean RF carrier power
- Power ramping
- Phase/frequency error
- Spectrum due to modulation
- Spectrum due to switching

Measurements results on the transmitter's traffic channel (TCH) are obtained by simply switching to the corresponding menu. The results are graphically displayed along with applicable statistical functions.

...AND RECEIVERS TOO!

You can also make the required tests on receivers.

- Bit error rate (BER)
- Adjacent time slot rejection

PLUS MANY OTHER MEASUREMENTS

You can also make may other base station measurements with the CMD 57 including:

- Echo test
- Module tests without signalling or time synchronization
- Alignment using built-in multifunction RF generator
- AF measurements with optional frequency counter

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2.*

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets
CMD57

Characteristics

TIME BASE TCXO
Standard –
Nominal frequency: 10 MHz;
Frequency drift (0 to 35° C): ≤1.5 x 10^{-6};
Aging (at 35° C): ≤0.5 x 10^{-6}/year.

With Opt. B1 –
Nominal frequency: 10 MHz; Frequency drift (0 to 50° C): ≤1 x 10^{-7}; Aging – ≤2 x 10^{-7}/year, ≤5 x 10^{-9}/day after 30 days operation.
Warmup time (at 25° C): Approximately 5 minutes.

Time Base OCXO (with Opt. B2) –
Nominal Frequency: 10 MHz.
Frequency Drift (0°C to 50°C):
Referenced to 25°C ≤5 x 10^{-9}.
Instrument turned by 90° (at 25°C) ≤1 x 10^{-8}.
After 2 hr warm-up at 25°C after 24 hr.
Out-of Service: ≤5 x 10^{-9}.
Aging: ≤3.5 X 10^{-8}/year, ≤5 x 10^{-10}/day after 30 days of operation.
Warmup Time (at 25°C): Approx. 10 minutes.

DC VOLTMETER
Measurement Range – 0 to ±30 V.

Resolution – 10 mV.

Error – ≤% + resolution.

DC AMMETER
Operating Modes – Current averaging with GSM-adapted time constant, current peak measurement (maximum and minimum).

Measurement Range – 0 to ±10 A.

Common-mode Rejection – ±30 V.

Resistance – 50 mΩ.

Resolution for Current Averaging – 1 mA/10 mA.

Resolution for Peak Measurement – 10 mA.

Residual Indication (no current at input) – ≤10 mA (at room temperature).

Error – ≤2% + residual indication + resolution.

AF MEASUREMENT UNIT
With Opt. B41 – Level, frequency, and distortion measurement in the range from 50 Hz to 10 kHz; frequency counter up to 60 MHz.
AF Generator –
Frequency Range: 50 Hz to 10 kHz;
Frequency resolution: 0.1 Hz;
Frequency Error: Same as timebase + half of resolution.
Level Range: 10 µV to 5 V;
Level resolution: At voltage <1 mV: 10 µV,
At voltage ≥1 mV: ≤1%;
Level error at voltage ≥1 mV: ≤5%.
Distortion: ≤0.5%.
Maximum Output Current: 20 mA.
Output Impedance: <5 Ω.

AF Voltmeter –
Frequency Range: 50 Hz to 10 kHz.
Measurement Range: 0.1 mV to 30 V.
Resolution:
At voltage <10 mV: 100 µV;
At voltage ≥10 mV: 1%.
Error: ≤5% + resolution.
Input Impedance: 1 MΩ.

Distortion Meter –
Frequency Range: 300 Hz to 3 kHz.
Input Level Range: 100 mV to 30 V.
Resolution: 0.1% of THD.
Inherent Distortion: ≤0.5%.
Error: ≤5% + inherent distortion.
Measurement Bandwidth: 10 kHz.

AF Counter –
Frequency Range: 20 Hz to 10 kHz.
Input Level Range: 10 mV to 30 V.
Resolution: ≤1 Hz.
Error: Same as reference + resolution.
Input Impedance – 1 MΩ.

IF Counter –
Frequency Range: 10 kHz to 60 MHz.
Input Level Range: 100 mV_{rms} to TTL.
Resolution: 1 Hz.
Error: Same as reference + resolution.
Input Impedance: Approx. 1 MΩ paralleled by 100 pG.

RF GENERATOR
Frequency Range –
GSM band: 890.2 to 914.8 MHz; DCS 1800 band: 1710.2 to 1784.8 MHz; PCS 1900 band (with Opt. B19): 1850.2 to 1909.8 MHz.

Frequency Accuracy – Same as timebase.

Resolution – GSM channel spacing 200 MHz.

Settling Time – <3 ms for phase error <2°.

Output Level –
RF IN/OUT/OUTPUT 2: GSM, DCS 1800 bands: –35 to –120 dBm; PCS 1900 band (with Opt. B19): –37 to –120 dBm.
Resolution: 0.1 dB;
Level error (RF IN/OUT/OUTPUT 2): ≤1.5 dB (≤1 dB at –104 dBm).

Harmonics (RF IN/OUT) – <–30 dBc.

Modulation – GMSK, B x T = 0.3.

Phase Error – <4° rms, <10° peak.

PEAK POWER METER (RF IN/OUT)
Frequency Range –
GSM band: 800 to 1000 MHz; DCS 1800 band: 1700 to 1900 MHz; PCS 1900 band (with Opt. B19): 1930 to 1990 MHz.

Measurement Range –
GSM band: 0 to 47 dBm; DCS 1800 band: 0 to 33 dBm (47 dBm with Opt. 14);
PCS 1900 band (with Opt. B19): 0 to 33 dBm (47 dBm with Opt. U6).

Resolution – 0.1 dB.

Error –
GSM band: ≤0.5 dB + resolution (P >10 dBm); DCS 1800 band: ≤0.8 dB + resolution (P >4 dBm); PCS 1900 band (Option B19): ≤0.8 dB + resolution (P >4 dBm).

VSWR – ≤1.3.

Communications Test Sets
CMD57

PHASE AND FREQUENCY ERROR MEASUREMENT

Frequency Range –
GSM band: 935.2 to 959.8 MHz; DCS 1800 band: 1805.2 to 1879.8 MHz; PCS 1900 band (Option B19): 1930.2 to 1989.8 MHz.

Level Range –
RF IN/OUT: GSM band: 0 to 47 dBm; DCS 1800 and PCS 1900 band (Option B19): 0 to 33 dBm.
RF IN 2: –60 to 0 dBm.

Inherent Phase Error – ≤1.5° rms, ≤5° peak.

Frequency Measurement Error –
≤5 Hz + timebase error.

BURST POWER MEASUREMENT

Frequency Range –
GSM band: 935.2 to 959.8 MHz; DCS 1800 band: 1805.2 to 1879.8 MHz; PCS 1900 band (with Opt. B19): 1930.2 to 1989.8 MHz.

Reference Level for Full Dynamic Range –
RF IN/OUT: GSM band: 10 to 47 dBm; DCS 1800 band: 0 to 33 dBm; PCS 1900 band (Option B19): 0 to 33 dBm.
RF IN 2: GSM, DCS 1800 bands: –37 to 0 dBm; PCS 1900 band (Option B19): –31 to 0 dBm.

Absolute Measurement Error of Peak Power –
RF IN/OUT: Unsynchronized: Same as peak power meter;
Synchronized to C0 carrier:
GSM band; ≤1.3 dB; DCS 1800 and PCS 1900 band (Option B19): ≤1.5 dB.

Inherent Ripple in Active Part of Time Slot – ≤0.1 dB.

HIGH-DYNAMIC BURST MEASUREMENT

Relative Error of Individual Test Samples –
≤1.5 dB to 72 dB below peak power.

Dynamic Range – >72 dB.

Measurement Limit –
RF IN/OUT: GSM band: <–36 dBm; DCS 1800 band: <–48 dBm; PCS 1900 (Option B19): <–42 dBm.
RF IN 2: GSM band: <–83 dBm; DCS 1800 band: <–85 dBm; PCS 1900 band (Option B19): <–79 dBm.

SPECTRUM MEASUREMENT

Dynamic Range – 80 dB.

Uncertainty – <±1.5 dB.

INPUT/OUTPUT

Interfaces –
RS-232C: 9-contact; Centronics: 25-contact; IEC/IEEE bus Interface (Option 07): Interface to IEC 625-1/IEEE 488, SCPI-compatible command set.

Reference Frequency Inputs/Outputs (Opt. B3) –
Synchronization input: Frequency (selectable): GSM bit clock (270.8 kHz), 2/4/16 GSM bit clock, 1 to 13 MHz in 1-MHz steps, 2.048, 26, 39, 52 MHz; Impedance: Approx. 100 Ω; Level: 0 dBm to TTL.
Synchronization output 1: Frequency: 10 MHz with internal reference or frequency at synchronization input with external reference;
Level: TTL, R_{out} = 50 Ω;
Synchronization output 2: Frequency (selectable): GSM bit clock, 2/4/16 GSM bit clock, 1, 2, 4, or 13 MHz; Level: TTL, R_{out} = 50 Ω.

A_{bis} Interface (Opt. B7) –
Receive channel (traffic/speech):
Unbalanced: 75 Ω/high-impedance;
Balanced: 120 Ω/high-impedance.
Time slot (selectable): 16 Kbit/s.

CMD 57 IN MULTICARRIER MODE (OPTION CMD-B8)

The specifications apply to all cases, in which interfering carriers (up to 30 dB above useful level) are more than 30 GSM channels away. If there are interfering signals close to the useful carrier, an additional IF filter is switched in (multicarrier mode).

TYPICAL FILTER CHARACTERISTICS IN MULTICARRIER MODE

Offset from useful channel (kHz)	Filter suppression (dB)
0	0 (reference)
200	<3
400	>20
600	>33
800	>41
1000	>48

This filter increases the measurement error for phase and power measurements.

Phase and frequency error measurement –
Inherent phase error: ≤2° (rms), ≤7.5° (peak).

Measurement of peak power/burst power –
Level error: ≤1.5 dB.

Communications Test Sets
CMD57

GSM-SPECIFIC SPECTRUM MEASUREMENTS
The dynamic range specified for the basic model refers to the sum of all input voltage components. The additional GSM carriers appear as strong spurious emissions in the spectrum measurement and have to be taken into account accordingly when evaluating the tolerances.

For additional detail on the Multicarrier mode, refer to the CMD57 datasheet.

ENVIRONMENTAL
Rated Temperature Range – 0 to +45°C (to DIN IEC 68-2-1/2).

Storage Temperature Range – –40 to +60°C.

Electromagnetic Compatibility – Complies with requirements of European EMC directive (89/336/EEC).

Mechanical Resistance –
Sine vibration: DIN IEC 68-2-6, 5 to 55 Hz, amplitude 0.15 mm, two cycles;
Random vibration: DIN 40046, part 24, 10 to 300 Hz, 10 ms/s^2 rms, 5 min/axis;
Shock: To MIL-STD-810D, 400 m/s^2, shock spectrum in six main axes.

POWER REQUIREMENTS
Line Voltage – 100 to 120 V AC ±10%; 200 to 240 V AC ±10%.

Line Frequency – 50 to 400 Hz ±5%.

Power Consumption (without options) – Approx. 85 W.

Electrical Safety – VDE 0411, Class 1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	363	14.3
Weight	**kg**	**lb.**
Without options	Approx. 14	30.8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CMD57
Digital Radiocommunication Tester.
Includes: Power Cord, Operating Manual, Spare Fuses.

CMD57 OPTIONS
Opt. B1 – OCXP 1.5 x 10^{-6} Reference Oscillator.
Opt. B2 – OCXO 1.5 x 10^{-7} Reference Oscillator.
Opt. B3 – Reference Frequency Inputs/Outputs.
Opt. B5 – Real Time Speech Coder/Decoder.
Opt B6 – Adapter for Other Options.
Opt.B7 – A_{bis} interface E1 and T1 (ver 6); includes 64 and 16 kbit signalling.
Opt. B8 – In Service Testing (Opt. B6 required).
Opt. B41 – AF Measurement with Frequency Counter.
Opt B44 – Multitone Audio Analysis (Opt. B41 and 8 MHz RAM required).
Opt. B61 – IEEE 488 Bus Interface (Opt. B6 required).
Opt. B62 – Memory Card Interface (Opt. B6 required).
Opt. K10 – Ericsson A_{bis} Control Software (RBS2000, RBS200).
Opt. K11 – Nokia A_{bis} Control Software (DE21, DE34, DE45).
Opt. K13 – NMC A_{bis} Control Software (S2000, S4000).
Opt. K14 – Siemens A_{bis} Control Software (BS20, BS60).
Opt. K30 – Signaling Software for MOC/MTC.
Opt. K43 – Narrowband Spectrum Analyzer Software.
Opt. K51 – Ciphering Software.
Opt. U3 – 11 dBm Second RF Output (9 dBm).
Opt. U5 – I/Q Demod Outputs and Trigger Input (BNC Connectors on Rear Panel).
Opt. U6 – Extended Attenuation to 47 dB.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

RECOMMENDED ACCESSORIES
Soft Carrying Case – Order CMD-Z40.
Handset – Order CMD-Z50.
Memory Card (Opt. B62 required) – Order CMDZ1.
Transit Case – Order ZZK-014.
Nortel A_{bis} Cable (2 meter) – Order CMD-Z20.
Note: For addition of options to existing units, please consult with your Tektronix representative.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Telecommunications Products

Tektronix Understands Your Needs

Until recently, telecommunications consisted largely of voice traffic traveling over dedicated and public lines at rates in megabits per second – satisfactory, but relatively slow compared to speeds possible today. Today, a range of technological changes has revolutionized the industry. Digital technology and gigabit transmission have expanded your service options – and your traffic load. And while telecommunications is an increasingly important strategic asset, most professionals in the industry are being asked to provide more service on tighter budgets.

Tektronix provides advanced test and measurement tools to network operators as well as designers and manufacturers of high-speed network transmission equipment.

If you're a network operator, Tektronix understands your need to reduce maintenance costs through lower cost equipment that's so easy to use it will lower your training and overall personnel costs, too. At the same time, the increasing amount of business-critical traffic on most networks means you need tools to help increase network uptime and integrity.

If you're a designer, manufacturer or evaluator of telecommunications equipment, Tektronix is aware of your need to boost your competitiveness, too. We're ready to help with equipment that can shorten your design cycle test times and contribute to efficient manufacturing test procedures.

The Customers We Serve

With over 40 years of leadership in test and measurement, Tektronix has unmatched expertise in telecommunications, video and high-speed networking that uniquely position us to meet your new, evolving requirements for test equipment. Our telecommunications products bring this expertise together to offer powerful, state-of-the-art technology and features to meet your budget and application needs.

For network operators, we provide innovative physical layer and transmission test equipment so you can install metallic, fiber and wireless networks with maximum efficiency, while reducing maintenance costs and improving network uptime. Our range of customers include local exchange telephone companies, independents and co-ops, interexchange carriers, cellular service providers, and local- and wide-area network providers.

If you're an equipment supplier, we can help too. Tektronix offers a line of products to help design, manufacture and test equipment for high-speed telecommunications transmission, data communications, opto-electronic components and sub-assemblies and microwave transmission. As standards proliferate, Tektronix is ready to help with equipment to test compliance with the growing range of specifications, including FDDI, SDH/SONET, fiber channel and HPPI.

CONTENTS

General Information 295
Optical Time Domain Reflectometers 298, 302
Trace Analysis Package 300
Handheld Optical Power Meter 304
Metallic Cable Testers 305
Telephone Cable Tester 306, 308
ISDN Subscriber Loop Portable Test Set 310
SDH/SONET Test Sets 314, 316, 320, 322
SDH/SONET Analyzer 324
VXI Programmable Optical Attenuator 330
Communications Signal Analyzer 332
Electrical Communication Adapter 336
Optical to Electrical Converters 338, 340, 344
SDH/SONET Reference Receivers 342
Optical Converters/ Power Meters 340, 359
Bit Error Rate Tester 348, 350, 352, 354
Optical Receiver Plug-in 356
Optical Spectrum Analyzers 357, 361
Optical Power Meter 359, 363
Optical Wavelength Meter 366

ACCESSORIES

Probes 438
SMD Adapters 474
Probe and Instrument Accessories 480
Printer 522
Instrumentation Carts 524
Visual Fault Finder 296
Optical LED Sources 296
ATM Analyzer 326

Telecommunications Products

Tektronix Understands Your Needs

Until recently, telecommunications consisted largely of voice traffic traveling over dedicated and public lines at rates in megabits per second – satisfactory, but relatively slow compared to speeds possible today. Today, a range of technological changes has revolutionized the industry. Digital technology and gigabit transmission have expanded your service options – and your traffic load. And while telecommunications is an increasingly important strategic asset, most professionals in the industry are being asked to provide more service on tighter budgets.

Tektronix provides advanced test and measurement tools to network operators as well as designers and manufacturers of high-speed network transmission equipment.

If you're a network operator, Tektronix understands your need to reduce maintenance costs through lower cost equipment that's so easy to use it will lower your training and overall personnel costs, too. At the same time, the increasing amount of business-critical traffic on most networks means you need tools to help increase network uptime and integrity.

If you're a designer, manufacturer or evaluator of telecommunications equipment, Tektronix is aware of your need to boost your competitiveness, too. We're ready to help with equipment that can shorten your design cycle test times and contribute to efficient manufacturing test procedures.

The Customers We Serve

With over 40 years of leadership in test and measurement, Tektronix has unmatched expertise in telecommunications, video and high-speed networking that uniquely position us to meet your new, evolving requirements for test equipment. Our telecommunications products bring this expertise together to offer powerful, state-of-the-art technology and features to meet your budget and application needs.

For network operators, we provide innovative physical layer and transmission test equipment so you can install metallic, fiber and wireless networks with maximum efficiency, while reducing maintenance costs and improving network uptime. Our range of customers include local exchange telephone companies, independents and co-ops, interexchange carriers, cellular service providers, and local- and wide-area network providers.

If you're an equipment supplier, we can help too. Tektronix offers a line of products to help design, manufacture and test equipment for high-speed telecommunications transmission, data communications, opto-electronic components and sub-assemblies and microwave transmission. As standards proliferate, Tektronix is ready to help with equipment to test compliance with the growing range of specifications, including FDDI, SDH/SONET, fiber channel and HPPI.

CONTENTS

General Information 295
Optical Time Domain Reflectometers 298, 302
Trace Analysis Package 300
Handheld Optical Power Meter 304
Metallic Cable Testers 305
Telephone Cable Tester 306, 308
ISDN Subscriber Loop Portable Test Set 310
SDH/SONET Test Sets 314, 316, 320, 322
SDH/SONET Analyzer 324
VXI Programmable Optical Attenuator 330
Communications Signal Analyzer 332
Electrical Communication Adapter 336
Optical to Electrical Converters 338, 340, 344
SDH/SONET Reference Receivers 342
Optical Converters/ Power Meters 340, 359
Bit Error Rate Tester 348, 350, 352, 354
Optical Receiver Plug-in 356
Optical Spectrum Analyzers 357, 361
Optical Power Meter 359, 363
Optical Wavelength Meter 366

ACCESSORIES

Probes 438
SMD Adapters 474
Probe and Instrument Accessories 480
Printer 522
Instrumentation Carts 524
Visual Fault Finder 296
Optical LED Sources 296
ATM Analyzer 326

Telecommunications Products

Products and Technologies

Tektronix offers a broad range of products that are grouped into eight categories:

- Optical time domain reflectometers (OTDRs) and optical fault finders measure and display the condition of fiber optic cable media. They locate faults over long distances and offer distance resolution down to the order of centimeters. These instruments are used in data communications networks, telephony networks, and cable television distribution system installation and maintenance.
- Metallic time domain reflectometers (TDRs) measure and display the condition of metallic cable media. They locate and characterize cable breaks and faults quickly and accurately. These testers are used in local area networks, as well as telephone networks and cable television networks.
- A handheld digital interface and protocol test set for Integrated Services Digital Network (ISDN)-compliant equipment is used by crafts-level telephony service personnel. The small, battery-powered unit is optimized for field use and is continually enhanced to meet customers' changing needs.
- SDH and SONET analyzers, either in a VXI configuration or as a standalone portable instrument, provide a broadband test platform that combines bit error rate testing, overhead testing and payload analysis.
- High-performance oscilloscopes acquire, display and measure repetitive telecommunications electrical and optical waveforms. They are optimized for eye pattern analysis and optical transmitter evaluation.
- Opto-electronic products include optical-to-electronic converters, optical attenuators, optical impulse generators and SDH/SONET optical reference receivers. These modular products are used with Tektronix high-performance oscilloscopes for a variety of complex fiber optic tests and measurements.
- Bit error rate testers provide digital stimulus generation and error response measurements up to 12 gigabits. They are used for design and evaluation of components and product sub-assemblies.
- Optical spectrum analyzers measure wavelength and spectral width of fiber optic sources. They are used to assure compliance of communications standards in the design of high-speed network transmission equipment.

Tektronix Support for Telecommunications

In addition to industry-leading products for telecommunications, Tektronix offers industry-leading support. Application guides and complete training support is available from the Tektronix worldwide sales and support organization. And all products are covered by our one- to three-year warranties. Any questions? Just contact your local Tektronix representative listed in the back of this catalog; inside the U.S. call 1-800-426-2200.

At Tektronix, we're committed to our telecommunications products customers. Whether you design, manufacture, install or maintain telecommunications equipment, we understand your needs and we'll always provide the best support tools available.

Visual Fault Finder, Optical Sources

TOP130 • TOP140 • TOP150 • TOP160 • TOP200 • New TOP220 • TOP300

Features

TOP130
- Dual Wavelength (850 nm and 1300 nm)
- Excellent Long Term Stability
- Selectable Output (CW or Modulated)
- Three Modulation Frequencies (270 Hz, 1 kHz, 2 kHz)
- >20 Hours Battery Life
- Universal (SOC) Interface

TOP140/TOP150/TOP160
- Stabilized Calibrated Output
- Hermetically Sealed Laser Diode for Longevity
- Selectable Modulation Frequencies (270 Hz, 1 kHz, 2 kHz)
- Universal (UCI) Connector Interface
- >80 Hours Battery Life

TOP200/TOP220
- Relative dB Mode for Direct Attenuation and Insertion Loss Measurement
- 0.01 dB Resolution
- Set Reference for Different Wavelengths
- Save References for Each Wavelength
- Universal (SOC) Interface
- >100 Hours Battery Life

TOP300
- High Brightness Visual Laser
- Universal (UCI) Connector Interface
- Fiber Tracing
- Fault Location to Millimeter Accuracy
- Long Battery Life
- Solid State Substitute for HeNe Laser

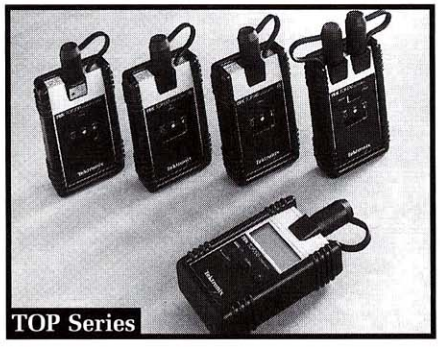
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.



TOP130 Optical LED Source

The Tektronix TOP130 Optical LED Source is a small, rugged LED source designed for use in installing, maintaining and researching telephony, datacom, CATV, FDDI and other fiber optic links.

The instrument provides two calibrated outputs: at 850 nm and 1300 nm. Providing both CW and modulated outputs, the user can set the modulation frequency to match the frequency signatures (270/1000/2000 Hz) required by fiber identifiers and signal tracers. The TOP130 comes standard with two universal (SOC) interface adapters.

TOP140/TOP150/TOP160 Optical Laser Source

The TOP140, TOP150 and TOP160 Optical Laser Source answer the request from the industry for small, rugged and truly versatile laser sources for use in installation, maintenance and testing of fiber optic systems. These laser source models cover the most used singlemode transmission windows: 1310 nm and 1550 nm. They feature both CW and modulated output modes. In CW mode these instruments feature extremely stable output power (–10 dBm). In the modulated mode the frequency may be set to 270 Hz, 1 kHz or 2 kHz by the user.

All laser sources feature the Universal Connector Interface which adapts to all standard fiber optic connectors via a complete line of simple, screw-on/screw-off UCI adapters.

TOP200/TOP220 Optical Power Meter

The TOP200/220 handheld optical power meters cover the full range of optical fiber applications. They are quality engineered for field and lab personnel requiring a high performance, cost effective, compact and rugged optical power meter.

The TOP200/220 utilize the Snap-On Connector (SOC) interface. Most industry standard fiber optic connectors can be accommodated.

The extraordinary design combines a state-of-the-art signal processor and microcomputer electronics to provide superb performance as well as simple and elegant operation with just three controls: ON/OFF, dBm/dB and λ. A reference value can be set and also saved for each wavelength.

The TOP200 provides measurements to +3 dBm levels. The TOP220 provides measurements for higher power level systems.

TOP300 Visual Fault Finder

The TOP300 Visual Fault Finder is specifically designed for field personnel who need an efficient and economical tool to visually check continuity and integrity of fiber installations, during and after installation. The highly efficient laser diode operates at short wavelengths which makes the emitted light visible to the human eye.

Difficult-to-locate fiber breaks are easily detected when using the TOP300 visual fault finder. Whenever the fiber is interrupted, the light escapes the fiber and becomes visible to the operator. Precise pinpointing of problems is immediate and intuitive to the user.

The optical connection is via the precision Universal Connector Interface (UCI) which offers superior repeatability, longevity, and ease of maintenance.

Characteristics

TOP130

Center Wavelength – 850 nm (830-870 nm), 1300 nm (1270-1330 nm).

Spectral Width (FWHM) –
850 nm: ≤55 nm. 1300 nm: ≤140 nm.

Stability (1hour) – ±0.05 dB.

Power Output (into 62.5/125GI MM fiber) –
850 nm: –13 dBm (50 µW).
1300 nm: –20 dBm (10 µW).

Power Output Uncertainty – ±1.0 dB (Calibrated launch level into 62.5/125 GI MM fiber).

Functions –
Mod: Modulated output mode.
CW: Continuous Wave DC output mode.
FREQ: Frequency is user selectable to 270 Hz, 1 kHz or 2 kHz.

Visual Power Meters

TOP130 • TOP140 • TOP150 • TOP160 • TOP200 • New TOP220 • TOP300

Power – Two AA batteries (>20 hours battery life).

Environmental –
Operating: –15°C to +55°C, 0-95% RH
Storage: –35°C to +70°C, 0-95% RH

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	72	2.8
Height	142	5.6
Depth	36	1.4
Weight	**g**	**oz.**
Net	240	8.4

TOP140, TOP150 AND TOP160

Center Wavelength –
TOP140: 1310 nm (1280-1340 nm).
TOP150: 1550 nm (1520-1570 nm).
TOP160: 1310 nm and 1550 nm.

Spectral Width RMS – –5 nm.

Stability*1 –
1 hour max. deviation: ±0.05 dB.
24 hours max. deviation: ±0.15 dB.

Power Output*1 (into SM-28/9 µm core) –
–13 dBm (100 µW).

Power Output Uncertainty*2 – (Calibrated launch level into SM-28/9 µm core) ±0.5 dB.

Functions –
Mod: Modulated output mode.
CW: Continuous Wave DC output mode.
FREQ: Frequency is user selectable to 270 Hz, 1 kHz or 2 kHz.

Connector Interface – Universal (UCI) Connector Interface

Power – Requires two AA alkaline batteries (TOP 140/150: >80 hours battery life) (TOP 160: >50 hours battery life).

Environmental –
Operating: –15°C to +55°C, 0-95% RH.
Storage: –35°C to +70°C, 0-95% RH.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	72	2.8
Height	142	5.6
Depth	36	1.4
Weight	**g**	**oz.**
Net	230	8

**1 Within specified ambient temperature of +20°C to +25°C.*

**2 Specified with properly terminated FC-PC, ST, SC, DIN, HMS-10/HP (2.5 mm) connectors. Uncertainty for other connectors may be higher.*

TOP200

Sensor Type – InGaAs (1 mm).

Power Range – +3 to –60 dBm.

Cal Wavelengths – 850/1300/1550 nm.

Absolute Accuracy – ±0.25 dB at calibration conditions.

Display – Liquid crystal display with 4-digit data field (0.01 dB resolution) and simultaneous display of cal wavelength.

Functions –
dBm: absolute power.
dB: Relative power; Also used to save/recall reference values.
λ: select CAL wavelength; also used to set default/CAL wavelength.
CAL: Calibrate unit.

Calibration Data – Data stored in non-volatile memory.

Connector Interface – Universal (SOC) Interface.

Power – Requires two AA alkaline batteries (>100 hours battery life).

Environmental –
Operating: –15°C to +55°C, 0-95% RH.
Storage: –35°C to +70°C, 0-95% RH.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	72	2.8
Height	142	5.6
Depth	36	1.4
Weight	**g**	**oz.**
Net	250	8.9

TOP300

Center Wavelength – 635 nm (615-660 nm).

Spectral Width (FWHM) – <1.2 nm RMS.

Power Output (into SMF-28 fiber) –
–6 dB ± 0.2 dBm (Class II).

Connector Interface – Universal (UCI) Connector Interface.

Power – Requires two AA alkaline batteries (>20 hours battery life).

Environmental –
Operating: –15°C to +40°C, 0-95% RH (non-condensing).
Storage: –35°C to +70°C, 0-95% RH (non-condensing).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	72	2.8
Height	142	5.6
Depth	36	1.4
Weight	**g**	**oz.**
Net	230	8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TOP130
Multimode 850/1300 nm LED Optical Source.

TOP200
Optical Power Meter.

TOP220
High Power Optical Power Meter.

TOP140
Singlemode 1310 nm Optical Source.

TOP150
Singlemode 1550 nm Optical Source.

TOP160
Singlemode 1310/1550 nm Optical Source.

TOP300
635 nm Visual Fault Finder.

TOP instruments can also be ordered as TFS3031/TFP2A options.
All include: User manual (070-9392-01); Protective Rubber Jacket with Stand (348-1480-00); and choice of one connector option. (Order additional connectors by 9-digit part number.)

CONNECTORS FOR TOP130/200/220
Opt. 30 – Biconic. Order 119-5168-00.
Opt. 31 – FC. Order 119-5146-00.
Opt. 32 – D4. 119-5167-00.
Opt. 33 – SMA. Order 119-5169-00.
Opt. 34 – ST. Order 119-5144-00.
Opt. 35 – DIN. Order 119-5166-00.
Opt. 36 – Diamd.3.5. Order 119-5172-00.
Opt. 37 – Diamd.2.5. Order 119-5171-00.
Opt. 38 – SC. Order 119-5145-00.
Opt. 39 – SMA 25. Order 119-5170-00.

CONNECTORS FOR TOP140/150/160/300
Opt. 30 – Biconic. Order 119-4515-00.
Opt. 31 – FC. Order 119-4516-00.
Opt. 32 – D4. 119-4514-00.
Opt. 33 – SMA. Order 119-4557-00.
Opt. 34 – ST. Order 119-4513-00.
Opt. 35 – DIN. Order 119-4546-00.
Opt. 36 – Diamd.3.5. Order 119-4558-00.
Opt. 37 – Diamd.2.5. Order 119-4556-00.
Opt. 38 – SC. Order 119-4518-00.
Opt. 39 – SMA 2.5. Order 119-4517-00.

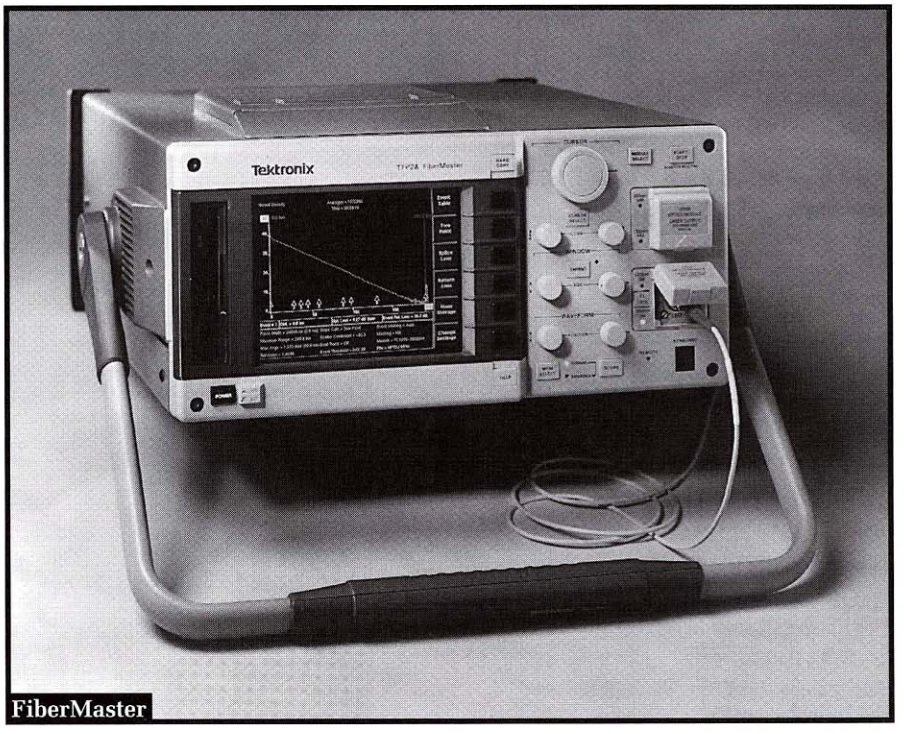
Optical Time Domain Reflectometer

TFP2A FiberMaster®

Features

FiberMaster

- High-speed Processing
- User-friendly
- High-resolution Color Display System
- Custom Configurable Design
- Dual Optical Plug-in Capacity Mainframe
- High-resolution and Long-range Performance
- Expandable Overview/Window Design
- Dual Trace Display Capability
- Automatic or Manual Mark Events
- Event Tables
- Pop-up Menus
- Automatic/Manual Masking
- Cleanable/Interchangeable Optical Connector Adapter
- High-resolution Internal Printer (Optional)
- Link and Event Return Loss Capability
- MS-DOS File Compatible
- Floppy Disk Drive
- Internal RAM (Optional)
- AT Compatible Keyboard Interface
- GPIB and RS-232C Interfaces
- PC Trace Analysis Software, FMTAP
- Remote Operation
- Language Options



FiberMaster

FiberMaster OTDR

The TFP2A FiberMaster sets a high level of performance and flexibility, providing faster, easier, more efficient solutions to fiber optic network testing requirements.

FiberMaster OTDR accommodates two dual-wavelength optical plug-in modules at the same time. Fully utilized, this feature gives you dual-wavelength multimode and dual-wavelength singlemode optical cable testing at the touch of a button. This allows testing of virtually any communications network, Telco, CATV or LAN without switching modules.

FiberMaster is driven by a high-speed 32-Bit processor that delivers clear, concise, accurate waveforms in a fraction of the averaging time taken by other OTDR systems which are based on traditional PC technology.

Characteristics

CRT DISPLAY

Size – 16.5 cm (6.5 in.) diagonal.

Resolution – 640 x 480 pixels.

Type (color) – CRT with Liquid Crystal Color Shutter.

Cursors – Selectable, dual independent.

Module Capacity – Maximum 2 plug-ins providing 4 wavelengths.

HARDCOPY OUTPUT

Internal Printer – High-speed/resolution dot matrix, thermal.

Resolution – 150 dots/in. vertical and horizontal (1.1 ratio to CRT Display).

Print Dimensions – 10.2 cm x 12.7 cm (4 in. x 5 in.).

GPIB to External – HPGL Plotter and HP ThinkJet.

RS-232C to External – HPGL Plotter, HP ThinkJet, Epson, Postscript.

Defaults – Factory and User Selectable.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Optical Time Domain Reflectometer

TFP2A FiberMaster®

Mass Storage – MS-DOS Compatible.

Internal Floppy Disk Drive – Size: 8.9 cm (3.5 in.); 1.44 MB or 720 KB.

Internal RAM – Capacity: 1 MB, non-volatile.

Keyboard Interface – AT compatible, 6-Pin modular.

DISPLAY RANGE

Vertical System – Vertical Display Range (one way): 1.0 dB to 100 dB. Loss Readout Resolution Range: 0.001 dB to 0.01 dB.

Mainframe Horizontal System – Distance Display Range: 1 m to 320 km. Distance Measurement Cursor Resolution 850 nm MM: 5 cm normal density; 1 cm high density. 1300 nm MM, 1310 nm SM, 1550 nm SM: 20 cm normal density, 10 cm high density.

Index of Refraction Range – 1.4000 to 1.6000.

Distance Measurement Accuracy – ±0.001%, ± min. cursor resolution, ± uncertainty in fiber cal. factor.

Number of Stored Waveform Points – 16 K max. (Normal), 32 K max. (High Density).

PHYSICAL CHARACTERISTICS

Dimensions*1	cm	in.
Length	60.7	23.9
Width	45.2	17.8
Height	19.8	7.8
Weight *2	**kg**	**lb.**
Net	15	33

**1 Includes front cover, handle and feet.*
**2 Includes mainframe optics module, internal printer, disk drive.*

Power Requirements – AC Operation: 90-130 V AC, 47-440 Hz, 180-253 V AC, 47-73 Hz. Optional 10-32 V DC.

Laser Product Safety Classification – Class I.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

FiberMaster with Color Display
Order TFP2A.
Includes: Operator's Manual (070-7906-05); Soft Carrying Case (016-1037-01); Front Panel Cover (200-3566-00); Power Cord (161-0104-00).

OPTICS PLUG-IN OPTIONS – MULTIMODE
Opt. 01 – 850 nm MM.
Opt. 03 – 850 nm/1300 nm MM.

OPTICS PLUG-IN OPTIONS – SINGLEMODE
Opt. 04 – 1310 nm SM. High Resolution.
Opt. 05 – 1550 nm SM. High Resolution.
Opt. 06 – 1310 nm/1550 nm SM. High Resolution.
Opt. 08 – 1310/1550 nm SM Long Range.
Opt. 09 – 1550 nm SM Long Range.
Opt. 10 – 1310 nm SM. General Purpose.
Opt. 11 – 1310/1550 nm SM. General Purpose.
For Options 01–11 select one connector per option at no charge.

CONNECTOR OPTIONS – MULTIMODE
Opt. 20 – Biconic (119-4515-00).
Opt. 21 – FCPC (119-4516-00).
Opt. 22 – D4PC (119-4514-00).
Opt. 23 – SMA906 (119-4517-00).
Opt. 24 – STPC (119-4513-00).
Opt. 25 – DIN 47256 (119-4546-00).
Opt. 26 – Diamond 3.5 (119-4558-00).
Opt. 27 – Diamond 2.5 (119-4556-00).
Opt. 28 – SCPC (119-4518-00).
Opt. 29 – SMA 2.5 (119-4517-00).

CONNECTOR OPTIONS – SINGLEMODE
Opt. 30 – Biconic (119-4515-00).
Opt. 31 – FCPC (119-4516-00).
Opt. 32 – D4PC (119-4514-00).
Opt. 33 – SMA 905/906 (119-4557-00).
Opt. 34 – STPC (119-4513-00).
Opt. 35 – DIN 47256 (119-4546-00).
Opt. 36 – Diamond 3.5 (119-4558-00).
Opt. 37 – Diamond 2.5 (119-4556-00).
Opt. 38 – SCPC (119-4518-00).
Opt. 39 – SMA 2.5 (119-4517-00).
Opt. 41 – FCAPC (119-5115-00).
Opt. 42 – SCAPC (119-5116-00).

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

FACTORY INSTALLED OPTIONS –
Opt. 14 – Internal RAM, 1 MB.
Opt. 1S – Trace Analysis Package PC Software – FMTAP
Opt. 16 – Internal High Speed Thermal Printer.
Opt. 17 – DC Power Input (10-32 V DC).
Opt. 19 – AT Compatible Keyboard. Order 118-7637-00 and 174-2356-00.
Opt. 1R – Rackmount Kits (fits 19 in. racks).
Opt. 1T – Hard Shell Transit Case. Order 016-1036-00.

OPTICS MODULES/CONNECTOR
When ordering Optics Modules for previously purchased mainframes, use the following numbers plus connector option:
FG1300 – 1310 nm Singlemode. General Purpose.
FG1315 – 1310/1550 nm Singlemode. General Purpose.
FM8500 – 850 nm Multimode, 62.5 µm.
FM8513 – 850 nm/1300 nm Multimode, 62.5 µm.
FM1300 – 1300 nm Multimode, 62.5 µm.
FS1500 – 1550 nm Singlemode. High Resolution.
FS1315 – 1310 nm/1550 nm Singlemode. High Resolution.
FL1315 – 1310/1550 nm SM Long Range.
FL1500 – 1550 nm SM Long Range.
Out-of-band wavelength modules available. Call for information.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

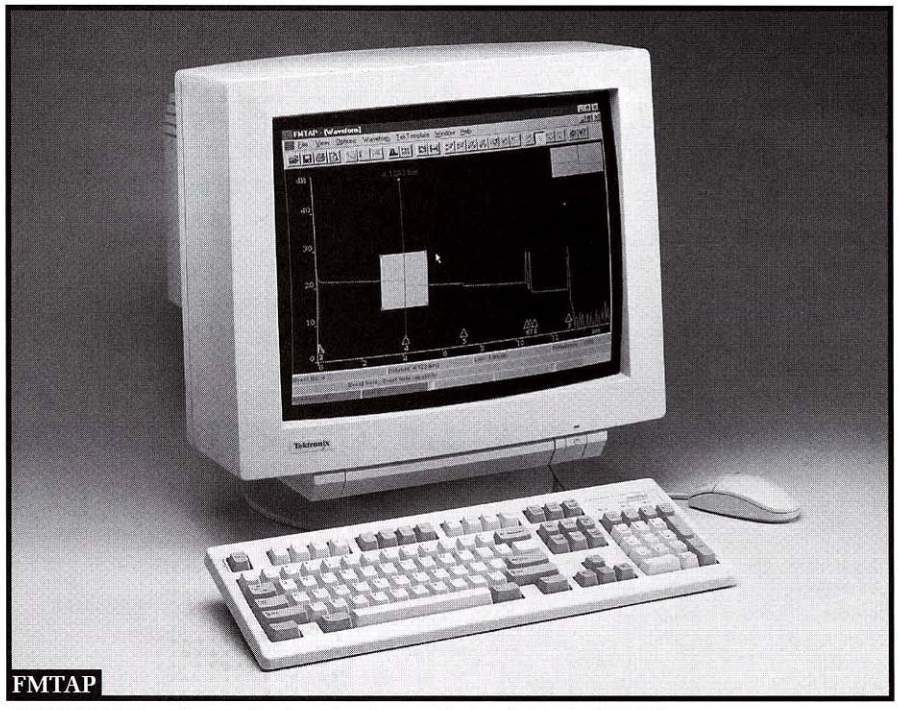
Trace Analysis Software, V3.0

FMTAP™ • FMTAP OTDR

Features

FMTAP

- Windows™ 3.1 and Windows '95 Compatible
- Bi-directional Event Averaging
- Batch File Comparison Against a Template Allows Faster Analysis of OTDR Data
- Batch File Printing and Data Export Functions Provides Easy Documentation of OTDR Data
- Extensive HELP Menus (feature HELP and application HELP) Make FMTAP Software Easy to Learn
- Easy to Install and Use



FMTAP OTDR software display showing analysis of a typical OTDR measurement.

FMTAP Version 3.0 OTDR trace analysis software allows you to access, analyze, and document OTDR test data from a PC Windows platform. You can easily analyze and document the quality of fiber links in your network using FMTAP software and your saved OTDR data files from Tektronix mainframe and mini-OTDRs including the TFP2, TFP2A, TFS3030, and TFS3031.

FMTAP version 3.0 software can perform the following functions on OTDR datafiles on a PC Windows platform:

- View a saved OTDR trace datafile
- View the trace event table and event notes
- View the acquisition parameters of the datafile
- View the filename and file notes of the datafile
- Edit filename, file notes, and event notes
- Measure splice loss, link loss, reflectance, link return loss, and fiber slope
- Adjust refractive index, backscatter factor, event threshold, and distance units
- Zoom in/out on any section of the trace
- Manually mark events
- Automatically mark events
- View two OTDR traces simultaneously
- Perform bidirectional measurements on OTDR traces
- Read .cff, .wfm, and .sor OTDR datafile formats
- Write .cff, .wfm, and .sor OTDR datafile formats
- Extensive HELP menus (features and applications)

In addition, FMTAP software provides the following documentation functions:

- Batch file printing of trace and table data
- Batch file comparison against a user-defined template
- Export OTDR data to other Windows software (word processing, desktop publishing, spreadsheets)

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Trace Analysis Software, V3.0

FMTAP™ • FMTAP OTDR

System Requirements:

Processor – 80486 or higher-based PC, math coprocessor recommended.

Operating System – Windows 3.1 or Windows '95 (Windows '95 recommended).

Base Memory – 640 K RAM minimum.

Extended or Expanded Memory – 4 MB minimum required.

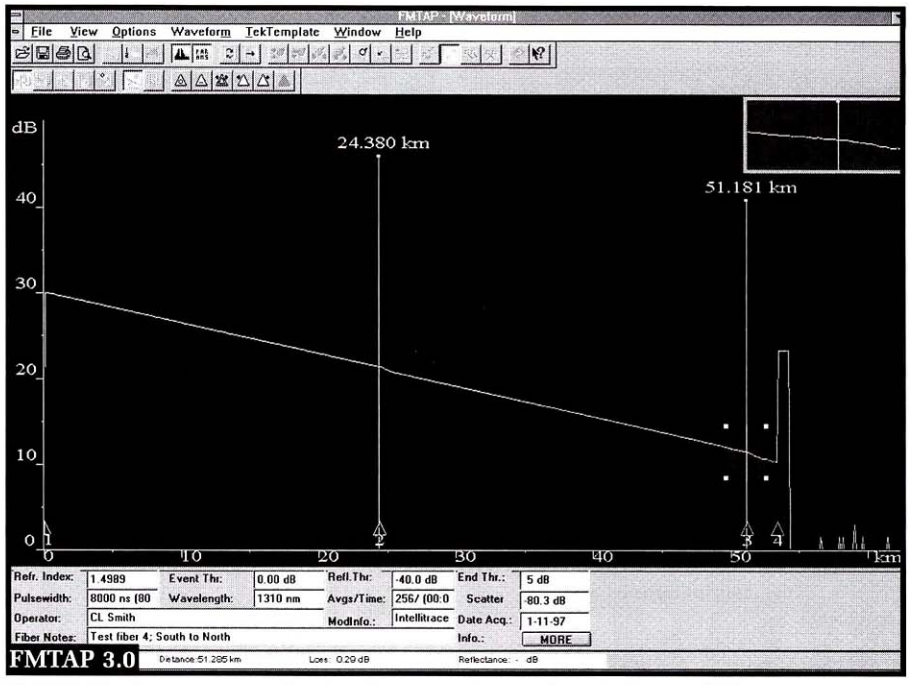
Graphics Adapter and Monitor – Windows-compatible color display.

Hard Drive – Minimum 5 MB available space.

Floppy Disk Drive – 3.5 inch, 1.44 MB IBM-compatible.

RS-232 Serial Port (optional) – For transferring stored tests from the TFS3030 to the PC. Not required to run FMTAP software.

Mouse – Two- or three-button Windows-compatible mouse.



FMTAP Version 3.0 screen showing data trace, expansion window, and fiber parameters.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

FMTAP OTDR

TRACE ANALYSIS SOFTWARE VERSION 3.0

Includes: Disk Pack (five 3.5 inch floppy disks).

User Manual – (070-9844-00).

Quick Reference Card – (063-2750-00).

Utilities Disk Pack – (119-5433-00).

FMTAP

FMTAP – FMTAP Software only. FMTAP may also be ordered as Opt. 1S to TFS3031 or TFP2A.

FMTAP-SL – FMTAP-Software Site License.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Mini Optical Time Domain Reflectometer

TFS3031 TekRanger®2

Features

TFS3031 TekRanger 2

- Improved! IntelliTrace™ – One-button Automatic Fiber Analysis
- New! Singlemode distance and loss measurements traceable to NIST
- Large, Backlit, High-resolution Display
- "Real Time" Testing
- Easy-to-change Wavelengths
- 5 Meter Singlemode Event Dead Zone
- 3.5 Meter Multimode Event Dead Zone
- 0.02 dB Loss Threshold
- Singlemode Dynamic Range 35 dB (Opt.10)
- Multimode Dynamic Range 31 dB
- 15 to 60 dB Selectable Reflectance Threshold
- Shock, Water, and Dust Resistant
- Echo Detection
- Compatible with FiberMaster®, FMTAP™, PC Spreadsheets
- Internal Memory for 100 Waveforms
- Software Upgradeable in the Field
- 4 Hour Battery Charge Time
- RS-232, Parallel and Keyboard Ports
- 3.5 Inch Internal Floppy-disk Drive (Optional)
- Mini-keyboard (optional)
- Multimode/Singlemode in One Unit (Optional)

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TFS3031 TekRanger 2

Tektronix Communications Test Business Unit provides a broad range of products in cable tests, transmission tests, and RF and wireless applications.

If your job is to install or maintain optical fiber, the TFS3031 TekRanger 2 with IntelliTrace Automated Fiber Analysis System is a rugged, easy-to-use, mini-optical time domain reflectometer (OTDR) that's built for you. It's designed to stand the rigors of field work, while providing precise measurements on singlemode or multimode optical fiber systems.

THE IntelliTrace ADVANTAGE
IntelliTrace technology automatically adjusts and optimizes acquisition parameters so you don't have to. Just press the **Start/Stop** button and it will provide you with the best possible resolution, while maximizing dynamic range to give you the most accurate measurements available in a mini-OTDR today. Unlike our competitors, one IntelliTrace acquisition provides consistent, repeatable, and accurate results. The location, reflectance, and loss of every splice appears quickly and clearly on the large, high contrast display.

The TFS3031 is the only mini-OTDR that can locate a splice **10 meters** away while also finding an end at 175 km away (on singlemode fiber) with the push of a single button. No need for multiple acquisitions to get a complete picture of your fiber, either with a displayed trace or event table. You get greater productivity.

NEW! TRACEABLE MEASUREMENTS
IntelliTrace technology has been improved. We can now offer traceability on singlemode distance and loss measurement. This means that we include both the hardware **and** the software in our accuracy specifications. What this means to you is that you can count on TekRanger 2 to provide the most reliable and repeatable measurements of any OTDR in the world. No other OTDR vendor can claim that!

SUPERIOR PERFORMANCE
TekRanger 2 sets a new industry standard for the combination of dynamic range and dead zone performance in a mini-OTDR. We've made it easier to resolve faults that are close together and we've given TekRanger 2 enough horsepower to locate a fiber end at over 175 km.

DATA STORAGE
Test results can be stored in the TekRanger 2's ample internal memory or collected on the optional floppy disk drive. Our new Windows™ based FMTAP software package gives you virtually unlimited flexibility when analyzing your optical fibers. The data can also be used in the Tektronix FiberMaster OTDR.

SYSTEM SOFTWARE UPDATES
TekRanger 2's disk drive and/or RS-232 port also permits updating of the unit's firmware in the field, so you can keep up with the latest technology.

Characteristics

Optical*1 –
850 nm optical output: 850 ± 30 nm.
1300 nm optical output: 1300 ± 30 nm.
1310 nm optical output: 1310 ± 20 nm.
1550 nm optical output: 1550 ± 20 nm.

Loss threshold: 0.02 dB minimum.
Loss resolution: 0.001 dB.

Dynamic and Measurement Range*1 –

	Dynamic Range	Measurement Range
850 nm (Opt. 01)	31 dB	25 dB
850/1300 nm (Opt. 03)	31/28 dB	25/22 dB
1310 nm (Opt. 04)	30 dB	24 dB
1310/1550 nm (Opt. 06)	30/28 dB	24/22 dB
1310/1550 nm (Opt. 10)	35/35 dB	28/28 dB

**1 Typical performance @ 25°C.*

Readout Resolution – 25 cm minimum.

OTDR Distance Range Settings –
Singlemode: 1 to 240 km.
Multimode: 1 to 40 km.

Distance Resolution (IntelliTrace) –
25 cm to 40 m.

Mini Optical Time Domain Reflectometer

TFS3031 TekRanger®

Measurement Time IntelliTrace Technology – Less than 3 minutes (20 dB accumulated loss).

Field Usage – Shock, water and dust resistant. Tested to Bellcore Mini-OTDR TR Environmental Specifications (i.e., 30-inch drop, shock, etc.).

ENVIRONMENTAL
(Without internal disk drive)

Operation Temperature Range – 0°C to +40°C.

Storage Temperature – –20°C to +60°C.

Relative Humidity – 5% to 95% (non-condensing).

PHYSICAL CHARACTERISTICS

Dimensions	cm	in.
Width	29.2	11.5
Height	11.4	4.5
Depth	4.1	9.5
Weight	**kg**	**lb.**
Net	4.2	9.2

Dead Zone (Options 01, 03, 04, 06, 10) –

	Event	Loss Measurement
Singlemode	5 m	15 m
Multimode	3.5 m	8 m

Display – High resolution 640 x 480; 7.2 inch, high contrast; Operator switchable backlight.

Selectable Pulse Widths – (dependent on option)
Multimode:
850 nm: 1 m, 5 m, 10 m.
1300 nm: 1 m, 5 m, 10 m, 20 m, 50 m, 100 m.
Singlemode: 1 m, 5 m, 10 m, 20 m, 50 m, 100 m, 200 m, 500 m, 1000 m, 2000 m, 3200 m (w/Opt. 10 only).

Memory Capacity – 100 traces in internal memory (typical). 3.5 in. floppy disk drive (optional).

Output Ports – RS-232 Serial; Centronix parallel printer, mini-DIN (keyboard).

Power Options – AC (100 to 240 V, 50 to 60 Hz). 9 to 16 V DC. Internal NiCad rechargeable battery (5 hours of operation depending on operating mode).

Safety – UL 3111-1 Listed. Certified to CSA C22.2 No. 1010.1-92. Class 1 Laser device.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TFS3031
TekRanger Base Unit.
Includes: Operator Manual (070-9027-05); Quick Reference Card (063-2096-01); NiCad Battery Pack (146-0112-00); Power/Charger Adapter (119-4545-01); Power Cord (161-0228-00); Soft Carrying Case (016-1215-02).

OUTPUT PORT OPTIONS
Multimode Options –
Opt. 01 – Single wavelength 850 nm.
Opt. 03 – Dual wavelength 850/1300 nm.
Singlemode Options –
Opt. 04 – Single wavelength 1310 nm.
Opt. 06 – Dual wavelength 1310/1550 nm.
Opt. 10 – Dual wavelength 1310/1550 nm extended range.

CONNECTOR OPTIONS

Multimode Option	Singlemode Option	Connector Type	Part Number
20	30	Biconic	119-4515-00
21	31	FCPC	119-4516-00
22	32	D4PC	119-4514-00
24	34	STPC	119-4513-00
25	35	DINPC 47256	119-4546-00
26	36	DIAMOND 3.5	119-4558-00
28	38	SCPC	119-4518-00
	41	FC/APC	119-5115-00
	42	SC/APC	119-5116-00

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V. Order 161-0066-09.
Opt. A2 – United Kingdom 240 V. Order 161-0066-10.
Opt. A3 – Australia 240 V. Order 161-0066-11.
Opt. A4 – N. American 240V, 60 Hz.
Opt. A5 – Switzerland 220 V. Order 161-0154-00.
Opt. A6 – Japan 110 V. Order 161-0288-00.
See Customer Information Section for additional description.

LANGUAGE OPTIONS
Opt. L1 – French.
Opt. L2 – Italian.
Opt. L3 – German
Opt. L4 – Spanish.
Opt. L5 – Japanese.
Opt. L6 – Portuguese.
Opt. L7 – Simple Chinese.
Opt. L8 – Standard Chinese.
Opt. LF – Finnish

MEASUREMENT SERVICE OPTIONS
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

OPTIONAL ACCESSORIES
Opt. 11 – Disk drive.
Opt. 19 – Mini-keyboard.
Opt. 95 – Test Data Sheet (Traceable info).
Opt. 1S – FMTAP™ Software.
Opt. 1T – Hard Transit Case (016-1210-00).
Opt. 2T – Optical LED Source, 850/1300 nm (TOP130).
Opt. 3T – Optical Laser Source, 1310 nm (TOP140).
Opt. 4T – Optical Laser Source, 1550 nm (TOP150).
Opt. 5T – Optical Power Meter, 850/1300/1550 nm (TOP200).
Opt. 6T – Visual Fault Finder, 635 nm(TOP300).
Opt. 7T – Optical Laser Source 1310/1550 nm (TOP160).
Hard Travel Case – Order 016-1210-00.
RS-232 PC Interface Cable – Order 012-1379-00.
FMTAP Trace Analysis Package – Order FMTAP.
Cigarette Lighter Power Adapter – Order 198-5810-00.
Centronix Parallel Printer Cable – Order 012-1214-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical Power Meter

TFC200 FiberChamp®

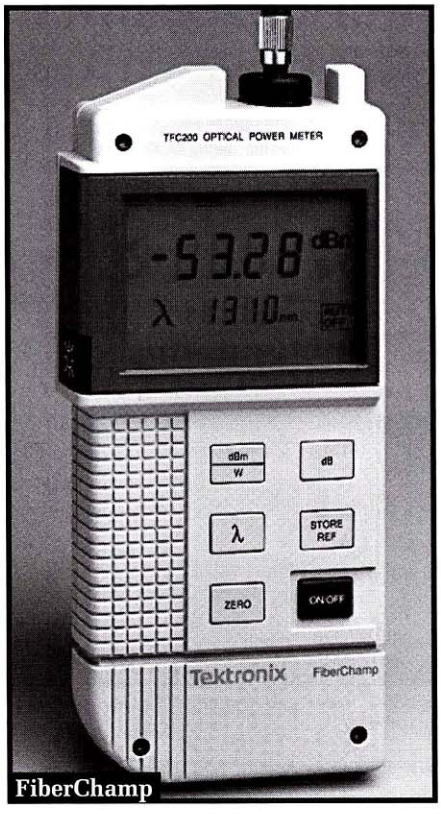
Features

FIBERCHAMP

- 3% Accuracy (1% typical)
- Selectable dB Threshold Audio Indicator
- Readouts in dBm, dB and Watts
- Multiple Calibrated Wavelengths: 780, 820, 850, 1060, 1300, 1310 and 1550
- Non-volatile Storage of Reference Power Level for Each Wavelength
- Averaging
- Analog Output Port
- Easy-to-use, Intuitive User Interface
- Large, Backlit LCD Display Is Easy to Read in Direct Sunlight or Total Darkness
- Battery or AC/DC Operation
- Wide Selection of Connector Adapters
- Interfaces to Multimode and Singlemode Fiber

Applications

- Absolute Power Measurements
- Link Loss
- Threshold Testing
- Monitoring Power Levels
- Telco
- CATV
- LAN
- R&D



FiberChamp

FiberChamp Optical Power Meter Characteristics

These specifications apply for use with all singlemode and multimode fibers up to 200 µm, 0.3 NA core with all connector options.

Spectral Range – 750 nm to 1700 nm.

Calibrated Wavelengths – 780, 820, 850, 1060, 1300, 1310, 1550 nm.

Dynamic Range – +10 dBm to –70 dBm.

Accuracy – ±3% (±0.1 dB). Note: At –20 dBm at 20°C at calibrated wavelengths (1% typical).

Readout Resolution – 4 digits, 0.01 dBm.

Display – Backlit LCD 6.98 x 5.08 cm (2.78 x 2.00 in.).

ENVIRONMENTAL

Temperature – Operating: –10°C to +45°C; Storage: –30°C to +75°C.

Humidity – 5 to 95% Relative Humidity (non-condensing).

Altitude – Operating: 4,500 meters (15,000 ft.); Storage: 15,000 meters (50,000 ft.).

POWER REQUIREMENTS

Internal – 9 V Alkaline (non-rechargeable) or 7.2 V, 6 cell NiCad (rechargeable).

Battery Life – Alkaline 28 hours, NiCad 8 hours.

External – 12 to 20 V DC (AC/DC converter) at 100 mA minimum.

PHYSICAL CHARACTERISTICS

Dimensions	cm	in.
Length	9.5	3.74
Width	3.3	1.3
Height	20.1	7.91
Weight	**kg**	**lb.**
Net	0.45	1

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TFC200
FiberChamp Optical Power Meter.
Includes: Operator Manual (070-7913-00); User Guide (063-0809-00); Carry Case (016-1078-00); Alkaline Battery (146-0094-00), and choice of one connector option. (Order additional connectors by 9-digit part number.)

CONNECTOR OPTIONS

Opt. 20 – Biconic. Order 131-5078-00.
Opt. 21 – FC. 131-4728-00.
Opt. 22 – D4. Order 131-5080-00.
Opt. 24 – ST. Order 131-5073-00.
Opt. 25 – DIN. Order 131-5181-00.
Opt. 27 – SMA. Order 131-5072-00.
Opt. 28 – SC. Order 131-5735-00.

RECHARGEABLE POWER OPTIONS

Opt. 0C – USA/Canadian 110 V.
Opt. 1C – European 220 V.
Opt. 2C – UK 240 V.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

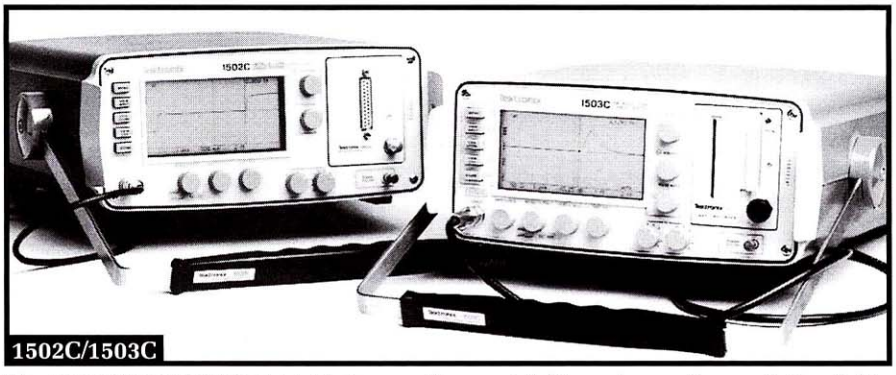
Metallic Cable Testers

1503C • 1502C

Features

1502C/1503C

- Direct Distance Readout – Accurate to Better Than 1%
- Intermittent Fault Monitor Mode
- High-resolution LCD Display With Zoom
- Menu-driven Setup
- Help Mode
- Rugged Portability
- Calibrated Vertical Scale
- Optional Serial Interface
- Optional Internal Printer
- Noise Filtering



The 1502C/1503C MTDR Cable Testers combine portability and ease of use with the ability to test most dual conductor metallic cable under virtually any condition.

1503C

GENERAL PURPOSE CABLE TESTER

This product generates a 1/2 sine pulse, with selectable pulse widths of 2, 10, 100, or 1000 ns. The high-resolution 2 ns pulse permits the identification of multiple faults as close together as one foot. The 1000 ns pulse gives the 1503C a range of 5,000 to 50,000 feet (depending on cable type and condition).

For most TDR applications, where determining distance to an impedance change is the key measurement, the 1503C is the best choice.

1502C ULTRA-HIGH-RESOLUTION TDR

The 1502C generates a 200 ps rise time step pulse and has an output impedance of 50 Ω. The fast rise time permits the identification of multiple faults as close together as 0.6 inches.

Sample Applications

LOCAL AREA NETWORKS

Cable and connector problems can be the biggest headache for the LAN installer. The 1503C's high-resolution 2 ns pulse will precisely identify problems in seconds. The calibrated vertical scale can help identify marginal components before they cause problems and a return call.

ON-BOARD SYSTEMS

The ultra-high resolution of the 1502C is perfectly adapted for testing critical wiring on board aircraft and ships.

MANUFACTURING QUALITY CONTROL

Manufacturers of circuit boards or precision cabling can quickly and accurately determine or verify the impedance characteristics of their products in a matter of seconds with the 1502C.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

1503C – Metallic General Purpose TDR.

1502C – Metallic High Resolution TDR.

Includes: AC Power Cord; 50 Ω BNC Terminator; Precision 50 Ω Cable (1502C); 93 Ω Cable (1503C); BNC-Cliplead (1503C); Female-to-Female BNC Connector; Spare Fuse; Operator's Manual; Accessory Pouch; Option Port Cover; Calculator Slide Rule.

Opt. 03 – Battery Pack. 1500C Series products meet environmental requirements of MIL-STD-28800C for Type III, Class 3, Style C, and utilize a high-performance internal gel-cell battery.

Opt. 04 – YT1S Chart Recorder. Records all information displayed on LCD, including waveform and settings for a permanent record.

Opt. 06 – (1503C only) Live Ethernet testing capability.

Opt. 08 – (1503C only) Token Ring TDR Adapter.

Opt. 09 – (1503C only) USOC Adapter.

Opt. 10 – (1503C only) Token Ring Interface.

SP232 Serial Interface Module – Provides a serial link to a host PC for remote control, waveform storage, and automated fault finding. **Includes:** Host software for IBM-compatible PCs.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 to A5.

See Customer Information Section for additional description.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Cable Tester for Telephone Applications

TelScout® TS100 • MCTAP

Display Resolution –
0.33% of selected range, 4.5 cm (0.15 ft.) minimum, on 640 x 200 high-resolution backlit LCD.

Display Ranges – Eleven display ranges plus single-button expand window. Ranges are user definable in manual mode.

Filter – High pass, cutoff frequency 150 kHz, user selectable.

Amplifier – 5 mV reflection produces a full-screen vertical deflection.

Gain – 0 to 63 dB.

Waveform Storage – Up to 20 waveforms with notes.

Horizontal Accuracy –
0 to 5,000 m: ±1 m ± uncertainty in Vp.
5,000 to 15,000 m: ±2 m ± uncertainty in Vp.

0 to 2,000 ft.: ±2 ft. ± uncertainty in Vp.
2,000 to 10,000 ft.: ±3 ft ± uncertainty in Vp.
10,000 to 20,000 ft.: ±4 ft. ± uncertainty in Vp.

Serial Interface – 9-Pin D-type serial connector.

General Characteristics

ENVIRONMENTAL
Temperature –
Operating: –15° C to +60° C.
Nonoperating: –20° C to +65° C.
Humidity: 95% RH, non-condensing.
Shock: (test specification) Survives drop of 2 m to concrete in standard soft case.
EMI Emissions: FCC part 15, subpart J, class A; VFG243 and EN55022.

POWER
Mains Operation –
Voltage Ranges: 110 V, 220 V, 240 V with appropriate AC to DC adapter.

Battery Operation –
Operating Time: 8 hrs. continuous.
Battery Saver: Selectable for 5 to 30 minutes or disabled.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	30	12
Width	25	10
Depth	9	3.5
Weight	**kg**	**lb.**
Net	3	6.4

MCTAP Trace Analysis Software

MCTAP, Trace Analysis Software for the TS100 TelScout TDR, allows you to use an IBM PC or compatible to display and analyze waveforms created by the TelScout software.

THE MEASUREMENT SCREEN
Once loaded into your PC, the measurement screen appears, displaying a menu bar, a status bar and the waveform display area, which includes a horizontal distance scale. The distance and marker are positioned where they were located at the time the waveform was written into mass storage in the TelScout software.

The waveform area of the measurement screen is color coded for easier interpretation of the data.

The control panel allows you to select the waveform to display, the measurement mode and cursor functions. You can also choose various waveform settings:

- Single- or dual-trace, or difference
- Units (Meters or Feet)
- V.p.

Other settings, which are not selectable but are displayed, include the pulse width, range, the cable identification and waveform notes.

System Requirements

Processor – 80386- or 80486-based IBM PC or PS/2 (or 100% compatible).

Operating System – MS-DOS or PC-DOS 5.0 or later. Windows 3.1.

Base Memory – 640 Kb RAM minimum, 580 K available.

Extended or Expanded Memory – At least 1 MB required (DOS not required).

Graphics Adapter – Color EGA or VGA.

Monitor – Color EGA or VGA.

Fixed Disk Drive – One MB minimum.

Floppy Disk Drive – 3.5 in., 1.44 MB or 5.25 in., 1.2 MB capacity. IBM compatible.

Mouse – Not required. (Two- or three-button Microsoft-compatible serial mouse possible to use.)

Math Coprocessor – (80287 or 80387) Not required.

Compatible Printers – IBM Pro Printer, Epson MX and FX, Hewlett-Packard ThinkJet, Hewlett-Packard LaserJet, Hewlett-Packard DeskJet, PostScript.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TELSCOUT TS100
Includes: Test Leads (two sets), Soft Carrying Case with Shoulder Strap, U.S. AC Adapter/Charger (120 VAC, 60 Hz, 9 V @ 1 A), Cigarette Lighter-DC Adapter, User Manual, Quick Reference Card, Rechargeable Internal Battery.

Opt. 01 – Adds 5 ns Pulse Width, Coax Setup Menu, and Adapter Cable.

Opt. 1C – Changes U.S. AC Adapter/Charger to 119-4240-00 Universal Euro Adapter/Charger (220 VAC, 1 A).

Opt. 2C – Changes U.S. AC Adapter/Charger to 119-4239-00 United Kingdom Adapter/Charger (240 VAC, 1A).

Opt. 3C – Changes U.S. AC Adapter/Charger to 119-4238-00 Australian Adapter/Charger (240 VAC, 1A).

Opt. 6C – Changes U.S. AC Adapter/Charger to 119-4241-00 Japanese Adapter/Charger (110 VAC, 60 Hz, 1 A).

INTERNATIONAL LANGUAGE OPTIONS
Standard – English.

Opt. L1 – French.

Opt. L4 – Spanish/Portuguese (Spanish default).

Opt. L6 – Portuguese/Spanish (Portuguese default).

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

MCTAP

Metallic Cable Trace Analysis Package.
Includes: Disk Pack: Contains one 3.5 in. and one 5.25 in. Floppy Disk; MCTAP User Manual (070-9306-00); RS-232C Cable (012-1379-00).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TDR Cable Tester for CATV

TV110 CableScout™

Features

TV110 CABLESCOUT

- One-step Setup and Acquisition
- Exclusive One Button Zoom/Overview Function
- Fully Automatic and Manual Control Modes
- Context Sensitive Help (Help Screens Available for All Functions)
- Internal Memory for 20 Waveforms with Notes
- Large, High-resolution Display (2.5 in. x 6 in.)
- Intermittent Fault Location
- Noise Reducing Digital Trace Smoothing
- Marker Function Measures Relative Distance Between Any Two Points
- Serial RS-232 Printer Output
- Rain, Dust, and Shock Proof Packaging (2 meter (6 ft.) Drop Tested)

Applications

THE TV110 CableScout IS DESIGNED SPECIFICALLY FOR CATV/COAXIAL CABLE APPLICATIONS

- Dedicated 75 Ω F Connector
- Pulsewidths Optimized for CATV/Coaxial Cable Runs
- Return Loss Measurement
- Sample Waveforms, Cable Types and Vps Stored in Memory

TV110 CableScout

CableScout TDR

If your job is to find faults on coaxial cable, the Tektronix TV110 CableScout is built for you. Designed specifically for CATV and other coaxial cable applications, The CableScout tester applies the newest technology to provide both ease of use and coaxial cable testing performance that cannot be found in any other TDR.

With the TV110, you'll spend less time operating the TDR and more time repairing faults. Simply select the cable type to be tested and the CableScout tester does the rest. Pulse width, Vp, gain, and vertical position are automatically selected and adjusted as you scan the cable. Finding the fault couldn't be faster; just move the cursor to the fault and use the one button zoom function to pinpoint its location. Identifying the fault is easy: just activate the dual trace display to compare your waveform to the stored sample CATV waveforms. Then use the TV110's standard waveform memory to store and document your results.

On the performance side, the CableScout tester employs optimized pulsing and sampling, coupled with advanced filtering and signal processing techniques. That way, you'll always have a clean waveform for easier event identification.

Best of all, you get all this performance and ease of use in the industry's most rugged TDR package. Come snow, rain, heat and humidity, the CableScout tester keeps working, because you have to.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TDR Cable Tester for CATV

TV110 CableScout™

Characteristics

Test Signal – 1/2 Sine.

Amplitude – 15 V into 75 Ω.

Output Impedance – 75 Ω.

Pulse Widths – 6 and 12 ns.

Input Protection – ±400 V, DC and ±400 V, peak AC, to 440 Hz.

Maximum Range – 1830 m (6000 ft.) depending on cable type and condition.

Display Resolution – 0.33% of selected range, 4.5 cm (0.15 ft.) minimum, on 640 x 200 pixel high resolution reflective liquid crystal display 6.35 x 15.24 cm (2.5 x 6 in.).

Display Ranges – Eight display ranges plus single button expand window.

Filter – High pass, cutoff frequency 150 kHz, user selectable.

Amplifier – A 5 mV reflection produces a fullscreen vertical deflection.

Gain – 0 to 63 dB.

Waveform Storage – Up to 20 waveforms with notes.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	300	12
Height	250	10
Depth	90	3.5
Weight	**kg**	**lb.**
Net	3	6.4

Horizontal Accuracy – 0 to 600 m = ±0.6 m, ±uncertainty in Vp. 601 m to 1,830 m = ±1 m, ±uncertainty in Vp. 0 to 2,000 ft. = ±2 ft., ±uncertainty in Vp. 2,001 ft. to 6,000 ft. = ±3 ft., ±uncertainty in Vp. Horizontal measurements in feet, meters, or time.

Mains Operation – 110 V, 220 V, or 240 V, with appropriate AC to DC adapter.

Battery Operation – 8 hours, continuous operation (4.6 A hours).

Battery Saver – 5 to 30 minutes or disabled, selectable.

Printer Interface – Serial 9-Pin D-type connector.

ENVIRONMENTAL

Operating Temperature – –15°C to +60°C (5°F to 140°F).

Nonoperating Temperature – –20°C to +65°C (–5°F to 150°F).

Humidity – 95% RH (non-condensing).

Shock – Survives drop of two meters (6 ft.) to concrete in standard soft case.

EMI Emissions – FCC part 15, subpart J, class A; VFG243 and EN55022.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TV110 CABLESCOUT
TDR Cable Tester for CATV.
Includes: BNC to Alligator Clips (F to BNC, and F to F Barrel Adapters), Coaxial Jumper Cable, Soft Carrying Case with Shoulder Strap, U.S. AC Adapter/Charger (120 V AC, 60 Hz, 9 V @ 1A), User's Manual, Quick Reference Card, Rechargeable Internal Lead Acid Battery, Cigaretter Lighter Charger, Standard 1 Year Warranty.

Opt. 1C – Changes U.S. AC Adapter/Charger to 119-4240-00 Universal Euro Adapter/Charger, 220 V AC, 6 A, 50 Hz.

Opt. 2C – Changes U.S. AC Adapter/Charger to 119-4239-00 United Kingdom Adapter/Charger, 240 V AC, 5 A, 50 Hz.

Opt. 3C – Changes U.S. AC Adapter/Charger to 119-4238-00 Australian Adapter/Charger, 240 V AC, 6 A, 50 Hz.

Opt. 6C – Japanese Adapter/Charger, 110 V, 1 A, 60 Hz (119-4241-00).

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

OPTIONAL ACCESSORIES

General Printer Cable – Order 012-1313-00.

Seiko DPU-411 Printer Cable – Order 012-1462-00.

Printer, Seiko DPU-411 – Order 119-4594-00.

Thermal Paper for Seiko Printer – Order 006-7840-00.**AC Adapter/Charger, 220 V AC for Seiko Printer** – Order 119-4648-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Subscriber Loop Portable Test Set

CrafTek™ CT-100 • Opt. 2A • Opt. 3B

Features

CRAFT TOOL FOR SUBSCRIBER LOOP INSTALLATION AND MAINTENANCE

- ISDN Basic Rate
- POTS/CLASS
- P-Phone EBS
- Rugged, Light-weight, Battery Operation
- ISDN Service Verification
- Call Setup
- Protocol Decode
- Automated BER Testing
- Dual Simultaneous Call Control
- NEBEs, FEBE
- Sealing Current
- P-Phone EBS Verification
- Signaling Channel
- DC Voltage
- Call Appearance and Feature Verification
- Speakerphone Output
- Internet Access Testing
- Personal Video Conferencing
- Telecommuting

Subscriber Loop Portable Test Set CrafTek CT-100

The CrafTek Subscriber Loop Test Set is designed to meet the changing needs of the telephony craftsperson, with flexibility to handle rapidly evolving and increasingly sophisticated digital technologies.

The CrafTek CT-100 allows today's work force to troubleshoot problems in the subscriber loop, without retraining. An easy-to-understand human interface, backed by a self-prompting, plain English display featuring extensive error messaging, allows the instrument to be put to work within minutes.

As the craftperson's primary installation and maintenance tool, the CrafTek CT-100 meets high standards for ruggedness, portability and reliability. In addition to traditional analog POTS service, the portable test set provides comprehensive ISDN and P-Phone measurements and indicators for rapid performance verification and fault diagnosis. New services can be provided more efficiently, customer downtime minimized and problems quickly resolved using the CrafTek CT-100 servicing solution.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

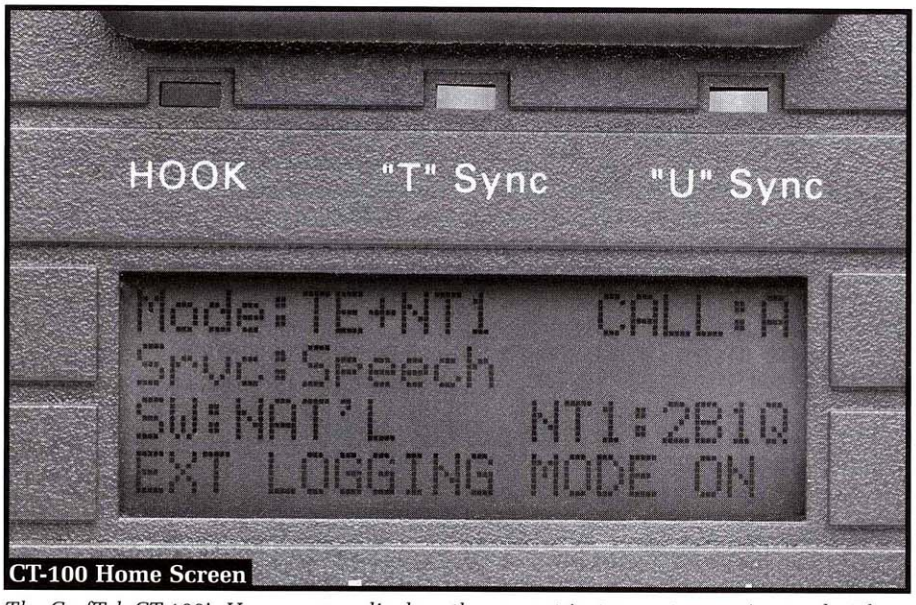
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Subscriber Loop Portable Test Set

CrafTek™ CT-100 • Opt. 2A • Opt. 3B



CT-100 Home Screen

The CrafTek CT-100's Home screen displays the current instrument operating mode. The word "LOG" indicates that data logging has been enabled.

CrafTek CT-100 RS-232 Serial Interface Troubleshooting Option 2A

The CrafTek CT-100's RS-232 interface (Option 2A) allows the user to connect an external device to the portable test set over a serial interface. This option provides for two capabilities when in use. The first is data sourcing, providing enhanced testing of ISDN D-channel packet data capabilities. The other capability is data logging, allowing the user to record results of installation and troubleshooting tasks.

PACKET DATA TESTING OVER RS-232

In the data sourcing mode, the RS-232 interface allows the user to connect a terminal and initiate X.25 packet-switched data calls over an ISDN data channel. This mode is useful when accessing packet gateways requiring more than a simple phone number (e.g., passwords), or to more fully verify D-channel user applications.

The operator connects their computer's serial interface to the unit's auxiliary jack (DB25-to-RJ45 adapters included). A PC communications software package can then be used to send standard Hayes-compatible modem commands to setup and maintain a D-channel packet call.

D-CHANNEL MONITOR

In the data logging mode, the user can use the RS-232 port to connect a printer or terminal directly to the unit. Details such as call setup, signaling protocols, and measurement results can be recorded for later analysis. Figures 1 and 2 provide examples of the type of information available when operating in the data logging mode. This mode of operation allows the user to monitor the events that are taking place on the D Channel.

For instance, the CrafTek CT-100 might be used to monitor a line over an extended period, recording time-stamped events such as synchronization loss or data transmission errors. A problem call could be documented from call setup to teardown to trace CPE or switch-related trouble, in the absence of more complex protocol analyzers. Or the technician may simply use the data logging mode to record results of the service verification procedures when on-site.

EASY INSTALLATION

The RS-232 interface board is installed in a separate option slot inside of the unit, and is accessed via the existing Auxiliary port on the base of the instrument. Hardware kits are available for easy field upgrading of existing instruments. The interface is fully isolated as well, preventing the risk of damage occurring if devices are directly coupled (e.g., ground loops).

```
14:36:25    [A] CALL Off-Hook
14:36:25    [A] CALL U1:          Call Init.
  Bearer Svc:          SPEECH
  Bch Request:         ANY
  Directory Num:       5551212
  Call Appearance:     1
  SPID:                01555121200
  Switch Type:         National ISDN 1
14:36:25    [A] CALL U2: Overlap Sending
14:36:31    [A] CALL U3: Out. Call Proc.
  Number: 5559999
14:36:35    [A] CALL U10:         Call Active
```

Fig. 1

Example of ISDN call progress.

```
00:03:25    PHYS    NEBE/FEBE Test
Started
  Test Duration:       00:01:00
  U pad attenuation:   0 dB
00:03:35    PHYS    NEBE Error:   3
00:03:38    PHYS    NEBE Error:   1
00:04:25    PHYS    NEBE/FEBE Stopped
  Elapsed Time:        00:01:00
  U pad attenuation:   0 dB
  NEBEs:  4           Error Sec.  2
  FEBEs:  0           Error Sec.  0
```

Fig. 2

Example of logging block errors.

```
14:43:01    [B] BERT Test Started
  Rate:                64K
  B-Channel:           B1
  SPID:                01555121200
14:43:02    [B] BERT Framed
14:43:02    [B] BERT Status:      0.00E-03
14:43:02    [B] BERT Status:      0.00E-04
14:43:04    [B] BERT Status:      0.00E-05
14:43:19    [B] BERT Status:      0.00E-06
14:43:32    [B] Bit Errors Inserted
14:43:32    [B] BERT Error:                1
14:44:01    [B] BERT Stopped -- Results:
  Bit Error Rate:          2.61E-07
  Bit Errors:                    1
  Errored Seconds:               1
  Blocks Received:            1929
  Block Errors:                  1
  Sync Losses:                   0
  Severely Errored Seconds:      0
```

Fig. 3

Example of results from BER test.

Subscriber Loop Portable Test Set

CrafTek™ CT-100 • Opt. 2A • Opt. 3B

Option 3B

NORTHERN TELECOM'S EBS

Enhanced Business Service (otherwise known as "EBS" or "P-Phone") is an analog Centrex offering provided by Northern Telecom (NORTEL). It operates over a single-pair subscriber wire loop which provides for full duplex audio conversations as well as a secondary signaling channel. This secondary channel is a half-duplex, 8 kHz amplitude-shift-keyed signal, which is used to transmit signaling information to and from the NORTEL switch and the CPE. Thus, the craftsperson is faced with a more complex servicing task when deploying and maintaining P-Phone lines.

When configured with the optional EBS interface card, the CrafTek CT-100 is capable of emulating an EBS Primary phone set, as well as several types of Add-ons. A simple set-up menu allows the user to select between a Primary set, select Add-on sets (18-, 20-, and 36-button), or a "monitor" mode which allows passive monitoring of both voice and signaling channels.

Unlike most EBS test sets on the market today which merely draw dial tone and place calls, the CrafTek portable test set adds crucial measurement and debug capabilities to aid the crafts technician.

In a typical EBS operating mode, the CrafTek CT-100 begins in place of the Primary set, allowing the user to go off-hook and place calls. Feature keys can be sent to emulate setting up multiple call appearances and verifying features such as call forwarding, hold, and release. The unit's LCD display simulates the display unit of the EBS Primary phone, showing such information as the number being dialed, the calling party's number, and other information sent by the CO switch for display.

POWERFUL TROUBLESHOOTING TOOL

Several important measurement capabilities are provided to further aid in EBS service verification and troubleshooting.

DC line voltage and polarity can be measured to verify that the voltage found on tip and ring is within operation specifications. (Showing red for reversed, green for correct).

The peak signal level of the 8 kHz secondary channel must also fall within certain parameters for proper signaling between CO and CPE. The measurement is made in terms of dB loss, with zero dB being calibrated to the nominal signal level found at the central office. Signal loss due to loop imperfections or extended length from the CO, as well as performance margin of the existing loop, can be quickly analyzed using this measurement.

Another useful tool for troubleshooting is to monitor messages that are being sent over the signaling channel. The CrafTek CT100 captures and displays in real time these hex data message elements being sent from the CO switch. One display allows the information to be viewed in raw hex data form (with the most recent 14 message elements displayed on screen). Another displays the same hex data in a decoded format (for example a hex value of "48" decoded is "Save Indicator Reset"). A buffer also retains the most recent 99 decoded message elements received for review.

Characteristics

OPERATING

Display – Supertwist Liquid Crystal (LCD), Backlit.

User Interface – Easy-to-use menus with extensive user prompts and error messages via 4-line x 20 character LCD.

Easy Configuration – Provides a step-by-step procedure for instrument setup.

Easy View – Provides a convenient way to review CrafTek status and settings.

Power Supply – Rechargeable NiCad battery pack. Alkaline "C" cells, or 120 VAC with adaptor. "Low Battery" and "Charging" indicators via LCD. Automatic shut-off.

Interface Ports – Four RJ45 type jacks (LINE, S/T(NT1), S/T(TE), AUXiliary)

Speed Dial – Storage for ten numbers (up to 22 digits per number) plus last number redial.

POTS

Dial Modes – DTMF, Pulse.

Functions – Meets monitor mode, talk mode, and acoustic response requirements as specified in Bellcore TR-TSY-000344.

Measurements – Polarity.

CLASS℠ – Support of "Customized Local Access Signaling Services" (Calling Line ID, Calling Name; with buffer).

ISDN TE

TE Compatibility – AT&T terminal equipment, NORTEL terminal equipment, and National ISDN equipment.

Software Generics – Currently compatible with AT&T software generics up to and including 5E9, NORTEL DMS-100 up to and including BCS-36; National ISDN-1 (AT&T, NORTEL, Siemens).

TE Functions – Provides basic voice services plus redirect. Supports BRITL (Basic Rate Interface Test Line). Supports D channel X.25 Packet Data testing. Supports call setup for multiple bearer services (speech, 3.1 kHz audio, 64 kbps and 56 kbps circuit switched data). Allows both B channels to be active simultaneously.

S/T Interface – Complies with T1.605-1991 ISDN Basic Rate Interface Specifications.

"T" Terminations – Selectable: Bridged, 100 Ω.

"T" Pad Attenuation – Range: 0 to 15 dB; Resolution: 1 dB.

"T" Synchronization – LED: Red=No sync; Orange=Sync, not activated; Green=Sync/activated.

Hook LED – Red=awaiting dial tone; Orange=negative acknowledgement; Green=dial tone/active call.

ISDN NT1

AMI Interface (Option 1B) – Meets specifications defined in AT&T Technical Reference 801-802-100 for AMI Loop Interface.

2B1Q Interface – Meets specifications defined in ANSI T1.601-1992 Standard. Complies with all 15 defined ANSI "U" loops. Supports Quiet and Insertion Loss modes (AC/DC Triggers).

S/T Terminations – Selectable: Bridged, 100 Ω, 50 Ω.

"U" Pad Attenuation – Range: 0 to 42 dB; Resolution: 1 dB.

"U" Synchronization – LED: Red=No Sync; Orange= Sync, not transparent; Green=Sync/transparent.

ISDN MEASUREMENT AND INDICATORS

Block Errors (NEBE/FEBE) – Total errors, errored seconds, selectable elapsed time.

Sealing Current – Presence with polarity indication.

2B1Q Battery – Presence with polarity indication.

Local Power – Presence with polarity indication.

S/T Power Sources 1, 2 and 3 – Presence with polarity indication.

TE Receive Level – Range: –9 dB to +3 dB; Resolution 0.5 dB.

Subscriber Loop Portable Test Set

CrafTek™ CT-100 • Opt. 2A • Opt. 3B

Indicators via LCD – INFO ("F" and "G") States, LAPD and CALL States, B channel, Current Call (A or B), TEI Number, ANI Number, CAUSE, and EOC messages, Sealing Current.

BER Testing – Provides 64 kbps and 56 kbps BER Testing on either B channel, or both B channels simultaneously.

B-Channel Loopback – Allows either B channel to be placed on loopback mode.

D-Channel – Provides X.25 packet data testing, including integrated "fox" message transmission.

40 kHz Test Tone Generation – Output 0 dBm ±2dB.

P-PHONE (EBS)

P-Phone Interface (Option 3B) – Provides support for NORTEL "Enhanced Business Service", including phone emulation for primary set, add-on sets, and Monitor mode (allows monitoring of voice and signaling channels); 2x16 message display.

P-Phone Measurements – DC Voltage and Polarity; Peak signal level of 8 KHz signaling channel; Signaling message elements (hex and decoded displays, with buffer).

RS-232 SERIAL PORT

RS-232 Interface (Option 2A) – Provides an RS-232 interface for D-channel packet data sourcing. Also supports data logging to a printer or terminal (ISDN protocols; measurements; EBS signaling; CLASS messages).

ENVIRONMENTAL

Physical Environment – Designed for rugged field use. Weather, moisture, dust and shock resistant.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Length	27.31	10.75
Width	8.38	3.30
Depth	8.26	3.25
Weight	**kg**	**lbs.**
Net w/NiCad battery pack	1.53	3.375

Safety – UL 1244; CSA C22.2.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CRAFTEK CT-100

Subscriber Loop Portable Test Set.

MEASUREMENT SERVICE OPTIONS

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

ACCESSORIES

User Manual – Order 070-7895-08.

Reference Guide – Order 070-7921-08.

Pocket Reference – Order 070-9632-00.

Rechargeable Battery Pack – Order 016-1072-01.

AC Adapter/Charger – Order 119-2731-00.

D6AM (6-Pin Jack) Cord – Order 012-1363-00.

D8W (8-Pin Jack) Cords – Order 012-1364-00.

RJ11 to Angled-Bed-Of-Nails Clips – Order 012-1365-01.

Soft Padded Carrying Case – Order 016-1073-00.

Warranty – One year.

FIELD UPGRADES

For upgrading existing units with new interface options and firmware features, contact your Tektronix Representative.

OPTIONAL ACCESSORIES

Opt. 1B – AT&T AMI "U" Interface.

Opt. 2A – RS-232 Interface.

Opt. 3B – EBS P-Phone Interface.

Opt. 46 – RJ45 to Angled-Bed-Of-Nails Clips. Order 012-1366-01.

Portable RS-232 Printer – Order 119-4594-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SONET Test Sets

CTS 710

Features

CTS 710

- 52 Mb/s, 155 Mb/s, and 622 Mb/s Transmit and Receive
- DS1 and DS3 Testing (Optional)
- Bit Error Rate Testing Including BIP Error Monitoring and Analysis
- Payload Mapping and Demapping
- Tributary Add, Drop and Test
- Pointer Generation and Analysis
- Alarms Generation and Analysis
- DCC and User Channel Access
- APS Testing
- Simple User Interface
- Automatic Setup
- Pass/Fail Testing
- Rugged Modular Design, Customer Configurable
- Disk Drive
- IEEE 488.2 and RS-232C

Applications

- Network Integrity Testing
- In-service Performance Monitoring
- Overhead Testing
- Tributary Mapping and Demapping
- Tributary Testing
- Stimulus and Response Testing
- Stress Testing

CTS 710

CTS 710

The ANSI standards for SONET specify requirements for the network element (ADM, multiplexers, terminals, etc.) interfaces. Installation, commissioning, maintenance and repair of the SONET network involves the challenge of testing to ANSI standards. The CTS 710 is ready for the challenge to assist with these and other testing needs. In one configurable, expandable and upgradable instrument you will find everything required to do your testing.

CONFIGURABLE

The CTS 710 is a rugged portable test set designed not only for your current tasks; through its unique architecture, it will grow with you as SONET grows. When you require additional capabilities such as optical interfaces, jitter analysis, ATM testing, etc., you can add such functionality to your CTS 710. This upgradability is important due to evolving nature of the standards, test requirements and equipment capabilities.

The CTS 710 is part of a new generation of test sets combining various different functions in one instrument with the power to go beyond basic testing. The modular nature of the test set allows you to configure the instrument to your needs, without the cost of unwanted built-in capabilities. Starting with a low cost platform which addresses your basic SONET testing needs, you can expand its capabilities as desired with a growing number of options.

EASY TO USE

The CTS 710 incorporates a number of new productivity features:

- AutoScan – Graphically presents the incoming signal structure and allows easy instrument setup
- Pass/Fail Testing – Automates following a written test procedure
- TroubleScan – Highlights error, alarms, and defects
- Graphical Displays – For historical trend analysis
- Online Help – For quick assistance with operation
- Disk Drive – For easy storage of instrument setups, Pass/Fail Test and results

This instrument employs innovative hardware technology which reprograms itself, depending on the operational mode. Future demands regarding access and control of particular bytes are easily reprogrammed. Upgrades are distributed on disks.

Please refer to the data sheet for more technical specifications.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, RS-232C, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

SONET Test Sets
CTS 710

CTS 710 SONET/DS3/DS1 Test Set

TRANSMIT AND RECEIVE RATES
- STS-1, STS-3 (electrical)
- STS-3c and OC-3c
- OC-1, OC-3, OC-12 (optical)
- DS1, DS3 (Opt. 22)
- Compliance to ANSI T1-105

GENERATION AND ANALYSIS
- Testing of Bit Error Rates including B1, B2, B3, VT BIP, Line FEBE, Path FEBE and Payload
- Complete alarm monitoring and generation
- Measurements: 1 sec to 99 days
- Histograms: 72 hours with 1 minute resolution. 45 days with 15 minute resolution
- Measurements with ANSI T1M1.3 analysis

OVERHEAD MANAGEMENT
Transport Overhead, Path Overhead and VT Overhead
- Set and View Byte Value: All
- Set and View Byte Trace Message: J1
- Add/Drop: DCCs, F1, F2

OTHER
- APS Control
- Pointer movement control
- Complete Pointer Sequence selection in accordance with ANSI T1X1.6
- Timing offset up to ±100 ppm
- DS1 and DS3 T-carrier testing (Opt. 22)
- Disk storage: 200 instrument setups, or 400 hours of results including histories, or 200 Pass/Fail tests on each disk (DOS compatible)

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	164	6.4
Width	491	14.25
Depth	1362	19.25
Weight	**kg**	**lbs.**
Net	10	22.5

Please refer to the data sheet for more technical specifications.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CTS 710
SONET DS3/DS1 Test Set.
Includes: User Manual, Reference Manual, Performance Verification, Front Cover, Accessory Pouch, 75 Ω Cable, Power Cord.

OPTIONS
Opt. 03 – Optical/Electrical Interface, 52 Mb/s, 155 Mb/s, 1310 nm.
Includes: Two Optical Connector Kits 020-1885-00 for FC-PC, ST, DIN, SC.

Opt. 04 – Optical/Electrical Interface, 52 Mb/s, 155 Mb/s, 622 Mb/s, 1310 nm.
Includes: Two Optical Connector Kits 020-1885-00 for FC-PC, ST, DIN, SC.

Opt. 05 – Optical/Electrical Interface, 52 Mb/s, 155 Mb/s, 622 Mb/s, 1550 nm, 0 dBm Power.
Includes: Two Optical Connector Kits 020-1885-00 for FC-PC, ST, DIN, SC.

Opt. 06 – Optical/Electrical Interface, 52 Mb/s, 155 Mb/s, 622 Mb/s, 1310/1550 nm.
Includes: Two Optical Connector Kits 020-1885-00 for FC-PC, ST, DIN, SC.

Opt. 22 – DS1 and DS3 Testing.
Includes: Standalone, Map/Demap and Add/Drop.

MEASUREMENT SERVICE OPTIONS
Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

FIELD UPGRADE KITS
CTS7F01 – Electrical Interface 52 Mb/s, 155 Mb/s, 75 Ω BNC.

CTS7F03 – Optical/Electrical Interface, 52 Mb/s, 155 Mb/s, 1310 nm.

CTS7F04 – Optical/Electrical Interface, 52 Mb/s, 155 Mb/s, 622 Mb/s, 1310 nm.

CTS7F05 – Optical/Electrical Interface, 52 Mb/s, 155 Mb/s, 622 Mb/s, 1550 nm.

CTS7F22 – DS1 and DS3 Testing.
Includes: Standalone, Map/Demap and Add/Drop.

ACCESSORIES
Rackmount – Order 016-0819-1x.
Optical Connector Kit –
Includes: FC-PC, ST, DIN, SC. Order 020-1885-00.
Battery Powered Printer – HC411 Opt. 04.
Hard Transit Case – Order 016-1157-00.
Soft Carrying Bag – Order 016-1158-01.

CART
Order K212.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, RS-232C, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

SDH/PDH and Jitter/Wander Test Set

New CTS 850

Features

- STM-0, STM-1, and STM-4 Transmit and Receive
- STM-16 Transmit and Receive (with ST2400)
- 2, 8, 34, and 140 Mbit/s PDH Mux/Demux Nx64 Kb/s
- PDH and SDH Jitter/Wander Test
- Performance Monitoring to G.821, G.826 and M.2100
- Dual Measurement Histograms for Correlations
- Pointer Analysis Including Pointer Sequences to G.783
- PDH/SDH Alarm Generation and Analysis
- Automatic Protection Switch (APS) Testing
- 1310 nm and 1550 nm Optical Interfaces
- Graphical Display of AU/TU Payload and Alarms
- Autoscan
- Pass/Fail Tests
- Jitter Measurement to G.823, G.825, 0.17s
- Automated Jitter Tolerance Measurements
- Wander Measurements Including MTIE

CTS 850

Tektronix is a leading supplier of a broad range of innovative test solutions for emerging communication networks.

The CTS 850 unlocks the power of the SDH frame structure by combining SDH bit error rate testing with overhead testing and payload mapping and demapping. It provides read/write access to all overhead bytes, DCC add/drop, SDH alarm generation and monitoring, frequency offset, APS control, pointer adjustment and monitoring, and G.783 pointer sequence movements.

The CTS 850 is optimized for installation and maintenance of both current and future SDH networks. Additional functionality, reflecting evolving standards, can be downloaded via the built-in disk drive, and changes in SDH overhead byte functions can be added with firmware updates. The CTS 850 also anticipates the future by supporting STM-0, STM-1, and STM-4 optical interfaces as well as STM-0E, STM-1E, and STM-4E (monitor) electrical interfaces.

One of the CTS 850's many powerful functions is error analysis and display. In addition to simple error counts and rate determination, the CTS 850 makes measurements according to G.821, G.826, and M.2100 performance primitives so that network quality of service can be fully verified.

Histograms boost the power of error analysis by enabling an easy correlation of time-critical events. Thus, time-consuming searches through long strips of error printouts are eliminated, freeing you to spend time fixing problems, not finding the cause.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SDH/PDH and Jitter/Wander Test Set

New CTS 850

PDH AND JITTER/WANDER TESTING

Many networks have evolved from PDH to include SDH rings and long-distance, high-capacity trunks. The PDH network segments are commonly retained for access, service delivery and economic reasons. The CTS 850, Option 38, PDH Tributary card provides new features for testing and accessing PDH sub-rates from 140 Mbit/s, 34 Mbit/s, 8 Mbit/s, 2 Mbit/s down to Nx64 Kbit/s. Additional PDH test features also include multi-layer G.826 results, Round Trip Delay, Voice Channel Monitor, Burst FAS Errors, and an 8 Mbit/s bipolar line interface.

This option also empowers the CTS 850 with mapping and demapping 2 Mbit/s, 34 Mbit/s and 140 Mbit/s payloads in virtual containers and testing of TU-12 and TU-3 overheads, making it ideal for testing hybrid networks.

To support current and emerging ITU-T and ETSI standards, CTS 850 Option 14 for Jitter and Wander provides the most comprehensive, easy-to-use measurements for both SDH, PDH equipment and networks. With its wide-ranging and comprehensive generation, analysis, pointer movement, and automated jitter output, transfer and tolerance testing, the CTS 850 is the complete solution for your current and future test requirements. Now the timing and synchronization of your new SDH/PDH equipment and networks can be fully tested and qualified.

VIDEO SERVICE PERFORMANCE

Digital video services demand a more stringent level of SDH timing and synchronization performance than many other services, since video quality can be visibly degraded. The CTS 850 Option 14 provides exclusive new measurements at the network interface to assess video service performance.

Summary of Features and Benefits

FLEXIBLE AND EASY-TO-USE

- Graphical display of AU/TU payload and alarms (AutoScan).
  - Provides the fastest signal identification. Allows quick identification of wrong provisioning and easy location of customer signal path.
- Pass/fail tests can be created, stored, and executed in the field.
  - Ensures a uniform test methodology in an increasingly diverse network. Allows faster installation and responsive maintenance.
- 3.5 in. Floppy Disk Drive.
  - Distribute firmware updates in the field. Archive Pass/Fail tests, and test results.
- Measurement Histograms with up to 1-second resolution.
  - Allows visual presentation of measurement results to customers.
- Cleanly structured menu system.
  - Enables all users (technicians, experts and occasional users) to be immediately productive.
- Large, bright CRT user interface.
  - Easy-to-see in low lighting conditions. Histogram resolution is clearly visible.

SDH TESTING

- STM-0, STM-1, and STM-4 Transmit and Receive.
  - STM-0 (51 Mbit/s) is becoming more prevalent in radio links/subsystems and SDH access systems.
- STM-16 Transmit and Receive (with ST2400).
  - Test STM-1/4 payloads in STM-16 ring.
- Performance monitoring to G.821, G.826, and M.2100 on all layers simultaneously.
  - Simplified testing for correct error performance compliance.
- Pointer test sequences exceed requirements of G.783.
  - Thoroughly stress the margins of equipment performance.
- PDH/SDH Defect generation and analysis.
  - Verify correct network response at all layers.
- Set and detect K1/K2 bytes. Present Span and Ring messages.
  - Send standard network messages and monitor network response. Verify protection switching system.
- 1310 nm and 1550 nm optical interfaces.
  - Swap between Long Haul/Short Haul trunk testing.

SDH/PDH and Jitter/Wander Test Set

New CTS 850

PDH TESTING

- Test 2, 8, 34, and 140 Mbit/s directly at each line rate.
  - Make traditional PDH measurements when necessary.
- Map unique test patterns into TU-12, TU-3 and AU-4 containers.
  - Verify correct provisioning and payload integrity.
- Test PDH signals dropped into SDH rates.
  - Monitor PDH services to verify tariffed performance.
- Add/Drop external 2, 34, and 140 Mbit/s signals to/from SDH containers and induce timing impairments.
  - Generate SDH test signals using cus tomer-generated PDH traffic. Add pointer sequences and jitter, test pointer hit toler ance of terminals and desynchronizers.
- Mux/Demux Nx64 K and low-speed PDH signals into/out of higher-speed PDH signals.
  - Verify correct PDH multiplexer/ demultiplexer operation.
- Round trip delay testing.
  - Verify the effects of incorrect network configuration.
- 2 Mb/s Channel Associated Signalling.
  - Verify channel busy conditions.

JITTER/WANDER TESTING

- SDH/PDH Jitter and Wander testing from 2 to 622 Mbit/s.
  - Complete solution in one option supports all installed interfaces, both generation and analysis. Exceeds all requirements of ITU-T O.171.
- Automatic conformance tests for output jitter, jitter tolerance, jitter transfer, pointer jitter.
  - Perform all standard ITU-T SDH/PDH equipment and network jitter/wander tests with quick, simple Pass/Fail tests. Supports G.783, G.823, G.825, G.958, G.735, and G.751 specifications.
- New Video Timing Quality measurements: Frequency drift-rate (ppm/sec).
  - Allows characterization of SDH networks for video applications. Correlate SDH pointer activity with video sub-carrier and Jsync drift.
- DSP jitter measurement technology.
  - Standards can easily be updated in firmware and distributed on a floppy disk. Measurements are more repeatable and reliable between two test sets.
- 200 UI jitter generation range exceeds requirements of ITU-T G.823, G.825.
  - Enables full margin testing of low frequency jitter/wander and full input tolerance testing.
- 200 UI jitter measurement range allows measurement of Pointer Hits.
  - Test set stays in lock, identifies/logs Pointer Hits on PDH service when dropped from SDH network.
- SDH/PDH line/clock wander and frequency measurement.
  - Allows diagnosis of network synchronization problems in the field.
- Full set of standard measurement filters plus measurements to 0.1 Hz.
  - Full-band jitter measurement (down to 0.1 Hz) allows characterization of phase transients that affect video, ATM, and PDH service quality.

SDH/PDH and Jitter/Wander Test Set

New CTS 850

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CTS 850
SDH/PDH + Jitter/Wander Test Set.
Includes: Power Cord and User Manual.

OPTIONS*1

Opt. 03 – STM-1 Optical Module 1310 nm.

Opt. 04 – STM-1/4 Optical Module 1310 nm.

Opt. 05 – STM-1/4 Optical Module 1550 nm.

Opt. 06 – Contains Opt. 04 and 05.

Opt. 14 – Jitter & Wander Testing.

Opt. 38 – Replacement for Opt. 36 PDH Analysis.

Opt. 50 – New 48 VDC option.

Opt. 96 – Certificate of Calibration/Traceability with tolerance values normally valid for 12 months.

**1 For Opt. 03/04/05/06 optical connectors must be specified.*

For language options other than English, contact your local Tektronix representative.

For replacement of front panel BNCs with 1.6/5.6 connectors contact your local Tektronix representative.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SONET Test Sets

ST112

Features

ST112

- OC-1/3/3c/12/12c Framing and Payload per Bellcore and ANSI Specifications
- Complete Overhead and Bit Error Rate Testing (BERT)
- Extended Control and Measurement Display via VT100 and RS-232 Support
- STS-3c/12c, DS3, and VT1.5 Payload Mappings
- User-upgradeable Software
- Unique VT1.5 Channel Scan and SONET Trouble Scan
- Standalone DS1/3 Test Capability
- Six DSX-3 or Six STSX-1 and Four DSX-1 Outputs
- LabVIEW®*1 Driver Compatibility
- Quick Setup for Automatic Configuration of Standard Test Modes
- AutoSeek (Automatic Detection of Receive Signal) and AutoLink (Receiver Follows Transmitter)
- Full SPE and VT pointer control
- Multiple Electrical Outputs for Four DS1, Six DS3/STSX-1
- Access to All SONET Overhead Bytes
- Data Communications Channel (DCC) Add/Drop
- Multiple Simultaneous Timed Alarms and Errors (for Software Regression Testing and Other Applications)

**1 LabVIEW is a registered trademark of National Instrument Corporation.*

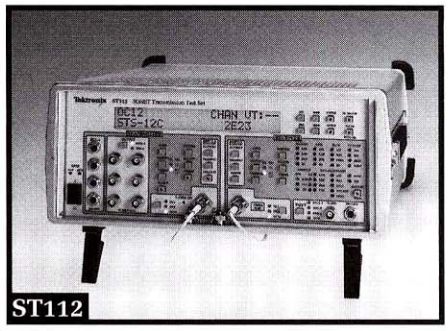
Applications

- SONET Network Element Testing
- Loopback Testing
- End-to-End Testing and Monitoring
- Path Provisioning and Performance Monitoring

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com



ST112 Portable Transceiver

The portable ST112 transmission analyzer is on the leading edge of today's growing need for SONET testing. It's designed not only to support today's needs, but tomorrow's emerging technologies as well. The powerful ST112 is a compact single-unit solution for providing extensive SONET STSX-1, OC-1/3/3c/12/12c signal generation and analysis for tributary and network testing. Optimized for lab-based conformance and field-based installation testing, the ST112 extends SONET testing technology to ATM by delivering a clear channel STS-3c concatenated mapping in addition to the standard DS3 and VT1.5 mappings. The ST112 combines easy-to-use, powerful test solutions with user-upgradeable software to meet evolving SONET standards.

RUGGED, PORTABLE DESIGN WITH POWERFUL FEATURES

While its portable, lightweight transceiver design makes the ST112 an ideal SONET test set, its extensive DSX-1 and DSX-3 test capabilities also provide outstanding network payload drop testings. At less than 22 pounds, the ST112 is the single-unit solution for all SONET testing where portability and ease-of-use are important. Standard RS-232, GPIB, and parallel printer interfaces, as well as VT100 terminal capability, provide the ST112 with complete remote control, display, and printed report features.

SIMPLE TO USE

The following features make the ST112 simple to use:

- Front-panel LEDs provide instantaneous identification of the operational status and alarms
- Built-in LCD screen displays test menus and results
- AutoLink feature automatically resets receiver to match user-updated transmitter settings
- VT100 terminal interface allows easy remote access to extended menus
- Interruptible pause/resume aids completion of long test cycles

UPGRADEABLE SOFTWARE EVOLVES WITH SONET STANDARDS

The ST112's advanced design enables the user to easily install software upgrades. This feature avoids obsolescence and keeps the ST112 on the leading edge of the evolving SONET standards.

EXTENSIVE SONET TEST CAPABILITIES

The ST112's SONET capabilities include not only optical carrier generation, but also STS-3c/12c, DS3, and VT1.5 payload generation. Additional features include:

- VT Channel Scan for testing VT mappings
- Event sync (Option 07) provides output signals for deriving switch timing or propagation delay from alarm conditions
- Byte synchronous payload mapping for next generation DLC testing
- Full error and alarm generation

The ST112 Receiver analyzes the incoming optical signal and displays performance monitoring information for the optical signal and payloads.

TROUBLESCAN SYSTEMATICALLY SEARCHES FOR ERRORS

The ST112 has been carefully engineered to enable the user to work smarter, not harder. For example, the ST112 Receiver has a unique, time-saving feature called STS TroubleScan, which systematically scans the entire input signal and displays any detected errors and alarms on all payload envelopes.

Characteristics

SYNCHRONIZATION INTERFACES

Internal –
SONET: 51.84 MHz ±10 ppm.
DS3: 44.736 MHz ±10 ppm.
DS1: 1.544 MHz ±100 ppm.

External – SONET: 51.84 MHz ±100 ppm; 155.52 MHz ±20 ppm.

SONET Test Sets

ST112

Loop Timing – Recovered Rx Clock to Transmitter.

BITS Timing – DSX-1 input used as Tx Timing Reference.

PAYLOADS

DS3 Payload –
General: A single internally or externally generated asynchronous DS3 signal is mapped into an STS-1 payload.
Frame Patterns: M13, C-bit, unframed.
Payload Patterns: $2^{23} - 1$, $2^{15} - 1$, AIS, Idle, All Ones.

Tributary VT1.5 Payload –
General: A single internally or externally generated asynchronous DS1 signal is mapped into a specified STS-1 payload virtual tributary.
Active channel pattern: PRBS $2^{23} - 1$, QRW, 3/24, 55 Octet, All Ones.
Framing: Unframed, SF, ESF, SLC96.
Modes: Floating, Bit Asynchronous, Simplified H4 Coding, Bit Synchronous Locked, Byte Floating, Byte Locked.
VT Pointer Justification: Positive and negative single justifications. New Data Flag (NDF) operations cause the pointer to jump to a new location.
Payload structure: DS1 payload is mapped into one channel or all 28 channels.

STS-3c/12c Payloads – An internally generated $2^{23} - 1$ PRBS sequence with valid path overhead.

ALARM AND ERROR GENERATION

Section – Loss of Signal (LOS), Loss of Frame (LOF), BER, Single error inject.

Line – Alarm Indication Signal (AIS), Far End Receive Failure (FERF), Bit Error Rate (BER), Single error inject.

Path – Loss of Pointer (LOP), STS Path Yellow, STS Path AIS, BER, Single error inject, Far End Block Error (FEBE).

VT – VT LOP, VT Path Yellow, VT Path AIS, BER.

Alarm Type – Burst or continuous, External TTL event trigger when alarm is activated.

Random Bit Error Injection – 1.5×10^{-3} to 10^{-9} rate or single.

Bipolar Pulse Violation – 1.5×10^{-3} to 10^{-9} rate or single.

EDITING

Transport and Path Overhead Byte Modification – All of the overhead bytes except B1-B3 and H1-H3.

Pointer Control – Single positive and negative pointer justifications and NDF pointer changes to any valid value for both SPE and VT.

GENERAL

Frame Detection –
STS-1: Detection based on A1, A2.
STS-3/12: Detection based on A1, A2, A2.

Indicator Lamps – LEDs provide current and history status for Section, Line, Path, SPE, VT, DS1, and DS3 status.

NOTE: CLASS 1 LASER PRODUCT. This product conforms to the applicable requirements of 21 CFR 1040 at the date of manufacture.

MEASUREMENTS

SONET Alarms –
Section: B1 Code Errors OOF (Out-Of-Frame), LOF, Frame pattern errors, LOS.
Line: B2 Code Errors, LOP, FEBE, AIS.
Path: B3 Code Errors, AIS, Yellow, FEBE, RDI.
VT: BIP-2, AIS, RDI, FEBE.

Payload Parameters –
VTI.5 payload to DS1 payload: Parity and frame errors, bit errors, AIS, Idle and All Ones, X-Bit.
VT1.5 payload: Bit Errors (PRBS or fixed word), AIS, Yellow, CRC-6, Frame errors, LOF.
STS-3c payload: Bit Errors.

T-carrier Parameters –
DS3: BPV, Parity, Bit, and Status parameters.
DS1: BPV, CRC, Bit, and Status parameters.

PERFORMANCE STATISTICS

Parameters –
Section (B1): Total, Rate, ES, SES Total.
Line (B2): Total, Rate, ES, SES Total.
STS Path (B3): Total Rate, ES, SES.
VT Path (BIP-2): Total, Rate, ES, SES Total.
Payload/DS3 (Bit and Parity): Rate, Total, ES, SES.
Payload/DS1 (Bit Error): Rate, Total, ES.
Payload/3c (Bit Error): Rate, Total, ES.

DATA COMMUNICATIONS CHANNEL

Section – D1-D3, 192 KB/s.

Line – D4-D12, 576 KB/s.

ORDERWIRE

Local and Express handset interface.

REMOTE INTERFACES

Ports – RS-232C, GPIB, parallel printer.

Drivers – VT100 terminal.

OPTICAL SPECIFICATIONS

OC-1/3 Tx Power Out – –9 dBm typical.

OC-12 Tx Standard Power Out – –8 dBm.

OC-12 TX High Power Out – –4 dBm.

OC-1/3/12 Rx Sensitivity – –30 dBm.

POWER

AC Line – 115/220 V AC ±10%.

Power Consumption – 250 W maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	152	6.0
Width	366	14.4
Depth	419	16.5
Weight	**kg**	**lbs.**
Net	10	22

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ST112
SONET Test Set DS1/3, STS-1.
Includes: Power Cord, Manual.
Opt. 03 – OC-1/3/3c 1310 nm FC Connector.
Opt. 04 – OC-1/3/3c/12 1310 nm FC Connector.
Opt. 06 – LabVIEW*[1] Drivers Remote Test.
Opt. 07 – Event Sync Output.
Opt. 08 – Payload Mappings; OC-12c/STS-12-c.
Opt. 1C – Replace BNC Connectors with WECO 560.
Opt. 2C – Replace 310 Connectors with Bantam.
Opt. 3C – Replace FC Connectors with SC.
Opt. 4C – Replace FC Connectors with ST.
Opt. 1M – Rackmount.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

RECOMMENDED ACCESSORIES
Soft Carrying Case for ST112 – Order 016-1442-00.
Hard Carrying Case for ST112 – Order 016-1443-00.

10 ft. 25-Pin Male-to-Male RS-232 Cable – Order 012-1384-00.
10 ft. 25-Pin Male to 9-Pin Female RS-232 Cable – Order 012-1298-00.

[1] LabVIEW is a registered trademark of National Instrument Corporation.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

SDH/SONET Test Sets

ST2400

Features

ST2400

- 2.488 Gb/s Section and Line Testing for OC-48 and STM-16 (2.4 Gb/s Multiplexer Section/Regeneration Section–Europe)
- Easy Front-panel Control – No External PC Required
- Configurable as a Receiver, a Transmitter, or a Transceiver
- Through Mode Operation
- Software Download of New Features
- Full-screen VT100 Operation
- Integrated ST112 Control Option for DS1 through OC-48 SONET Testing
- Works with CTS 850 for E1 to STM-16 SDH Testing
- Compact Size for Portability
- Payload Independent
- Special Optics for WDM and Hybrid Applications
- Dual Wavelength Available with ±10 nm

Applications

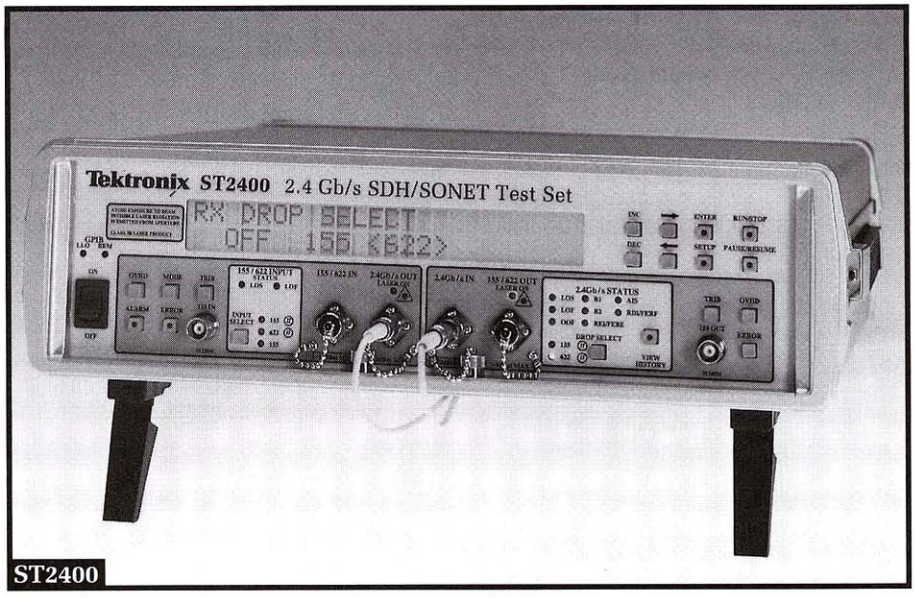
- Testing of 2.4 Gb/s SDH/SONET Network Elements and Transmission Lines
- 10 Gb/s System (OC-192 or STM-64) Drop Testing
- Independent Monitoring and Arbitration at System Boundaries
- Network Evaluation, Provisioning, and Maintenance
- SDH/SONET Bit Error Rate Tester for SDH/SONET Component and Equipment Manufacturers (Conformance and Compliance)

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

CE



ST2400

ST2400 2.4 Gb/s SDH/SONET Test Set

The ST2400 provides intuitive 2.4 Gb/s SONET and SDH testing in a portable package. The ST2400 operates: 1) Standalone; 2) In conjunction with Tektronix ST112/CTS710/CTS850 or 3) Through Mode. The ST2400 is easy to use and helps assure the "health" of your network. The ST2400 is easy to use and helps assure the "health" of your network.

The 2.4 Gb/s transport capacity offered by STM-16 and OC-48 systems represent the equivalent of over 32,000 voice channels. That's a lot of customers, all of whom expect uninterrupted, high quality service.

The ST2400 works alone or with lower-rate SDH/SONET testers to assure that your critical 2.4 Gb/s transport systems are installed and operating correctly. If troubles occur, the ST2400 can locate and help you fix problems quickly.

The ST2400 provides passive monitoring and active testing. It operates in both "through" and "terminal" modes. The ST2400 applications include section and line testing of 2.4 Gb/s SDH/SONET network elements and transmission lines for product evaluation, provisioning, and maintenance; 10 Gb/s system (OC-192 or STM-64) drop testing and independent monitoring and arbitration at system boundaries, such as between LEC (Local-Exchange Carrier) and IXC (Inner-Exchange Carrier) networks or between SONET and SDH networks. In through mode, the 2.4 Gb/s signal can transmit the received signal unchanged or have alarms and errors injected for stress and conformance testing.

The ST2400 does not require a separate computer for control and is about half the size of most 2.4 Gb/s testers.

PASSIVE MONITORING

The ST2400 Receiver provides cost-effective, independent, and non-intrusive monitoring of LEC-IXC, SDH/SONET, or other cross-boundary 2.4 Gb/s lines. Results can be monitored remotely via RS-232 or GPIB. ST112/ST2400 integrated control software is available for full-rate SONET testing. The OC-48/STM-16 optical signals to be tested are split through a passive coupler which is located in an optical cross-connect bay or other convenient location. Since there is no active regeneration of the optical line, the system-under-test must have adequate margin to allow insertion of the coupler. Measurements can be made with the ST2400 (receive only configuration – Opt. 11), which is very cost effective for passive monitoring. As required, an ST112 or other SDH/SONET tributary test set can be used in conjunction with the ST2400. Measurements are made with the ST2400 and, as required, the ST112 or similar tributary tester.

SDH/SONET Test Sets

ST2400

ACTIVE ANALYSIS OF THE 2.4 GB/S LINE
For active analysis of the 2.4 Gb/s line, the ST2400 is actively inserted into the signal path. An ST112 or any 155 Mb/s or 622 Mb/s SDH/SONET test set is required to provide a framed signal input to the ST2400. The ST2400 provides a variety of signal and analysis options for complete testing of the 2.4 Gb/s line.

ACTIVE "THROUGH" ANALYSIS OF THE 2.4 GB/S LINE
For active "through" analysis of the 2.4 Gb/s line, the ST2400 is actively inserted into the signal path as either a regenerator or as a stress tester. The OC-48/STM-16 signal is looped through the ST2400. The signal can be passed through regenerated and unchanged or with alarms and errors added for stress or conformance testing. Standalone, the ST2400 can quickly verify the 2.4 Gb/s signal for correct operation. In conjunction with a companion SDH/SONET tributary test set such as the ST112, CTS710, or CTS850, the ST2400 can make all the transmission measurements required to completely test the SONET system.

Characteristics

TRANSMITTER
Source Modes – 2.4 Gb/s output created from: 1) 155 Mb/s electrical CMI or optical input; 622 Mb/s optical input; 2) Internally generated 2.4 Gb/s signal; 3) In through mode, the incoming signal is transmitted.

Error Inject – Single section errors or error rates from 1 x 10^{-3} to 1 x 10^{-9}, selected channel or all channels.

Alarm Generation –
LOS: User-selected from 1 to 127 µs.
LOF, OOF, L-AIS, L-FERF: User-set for 1 to 127 frames or continuous.

Transport Overhead Manipulation –
All TOH bytes (except the pointer and parity bytes) can be overwritten, continuously or for up to 127 frames.

Other Outputs – 50 Ω ECL frame sync, 50 Ω TTL event trigger.

NOTE: 1310 laser is Class 3B, 1550 laser is Class 1. To prevent personal injury, refer to the safety requirements provided in the ST2400 User Manual.

RECEIVER
Drop Modes – 155 Mb/s electrical and optical drop or 622 Mb/s optical drop.

Measurements – The 2.4 Gb/s input is monitored for section (B1) and line (B2) parity errors and line FEBE (REI/FEBE) errors.

Alarms Detected – The 2.4 Gb/s input is monitored for LOS, LOF, OOF, B1, B2, REI/FEBE, AIS (line), and RDI/FERF.

Overhead Display – All overhead bytes can be displayed.

REMOTE CONTROL AND PRINTING
Interface – IEEE 488.2 GPIB, Two RS-232C serial interfaces (one for ST112 integrated control), Parallel printer interface.

POWER
AC Line – 100 to 240 V AC.

Maximum Power Consumption – 250 W maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	114	4.5
Width	366	14.4
Depth	419	16.5
Weight	**kg**	**lbs.**
Net	10	22

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ST2400
SDH/SONET Test Set.
Includes: Manual, Power Cord.

Opt. 11 – Receive Only with 2.4 Gb/s Wideband Optics.

Opt. 12 – Transmit Only with 1310 nm Tx Long Reach 2.4 Gb/s Optics.

Opt. 13 – Transceiver with Wideband Rx Optics and 1310 nm Tx Long Reach 2.4 Gb/s Optics.

Opt. 14 – Transmit Only with 1550 nm Tx Long Reach 2.4 Gb/s Optics.

Opt. 15 – Transceiver with Wideband Rx Optics and 1550 nm Tx Long Reach 2.4 Gb/s Optics.

Opt. 16 – Transmit Only with Switchable 1310 nm Tx Long Reach and 1550 nm Tx Long Reach 2.4 Gb/s Optics.

Opt. 17 – Transceiver with Wideband Rx Optics and Switchable 1310 nm Tx Long Reach and 1550 nm Tx Long Reach 2.4 Gb/s Optics.

Opt. 1A – 15 dB FC-PC Attenuator for 2.4 Gb/s Rx.

Opt. 1M – Rackmount.

Opt. 3C – Replace FC connectors with SC connectors.

Opt. 4C – Replace FC connectors with ST connectors.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

RECOMMENDED ACCESSORIES
Hard Carrying Case for ST2400 – Order 016-1494-00.

Rackmount – Order 016-1407-00.

10 ft. 25-Pin Male-to-Male RS-232 Cable – Order 012-1384-00.

10 ft. 25-Pin Male to 9-Pin Female RS-232 Cable – Order 012-1298-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

SDH/SONET Analyzers

SJ300E

Features

- Generates and Measures Jitter on SDH/SONET Optical Inputs, up to 622 Mb/s
- Measures Jitter Generation, Transfer, and Tolerance
- Stores and Executes Test Sequences for Jitter Tolerance and Transfer Testing
- Detects and Records Jitter Hits
- Generates and Measures Wander on 1.544 Mb/s and 2.048 MHz Synchronization Signals
- Generates and Measures Jitter Up to 622 Mb/s
- Wander Option (Opt. 06) Includes PC Software for Uploading, Calculating and Analyzing Wander Data
- Data Correlation Method Used to Measure Jitter Transfer Provides Superior Accuracy
- Measures and Generates Wander on SDH/SONET Lines
- Tests Conformance to all ANSI, Bellcore, and ITU-T Timing Standards – CCITT G.958, CCITT G.703, ITU-T G.813 July 95, Bellcore GR-253-CORE (TR-NWT-000253), ANSI T1.101, and ANSI T1.120
- RS-232 and GPIB Interfaces for Remote Operation
- Real Time Wander Analysis and Display
- Adapter Available for STSX-1 and STSX-3 (STM-1e) Analysis

Applications

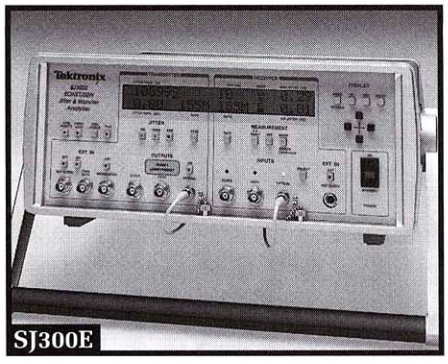
- Measure Jitter and Wander Generated and Tolerated by SDH/SONET Equipment and Clock-recovery ICs
- Measure Jitter and Wander Transfer of SDH/SONET Equipment
- Measure or Monitor Jitter and Wander at Line or Synchronization Interfaces
- Generate and Analyze Line and Synchronization Phase Transients

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

CE



SJ300E SDH/SONET Jitter and Wander Analyzer

SDH/SONET jitter and wander are causing increased concern in the industry. The SJ300E provides the assurance that your systems are operating properly. It enables manufacturers and service providers to verify proper operation and standards compliance of their products and networks. With its comprehensive measurements and associated analysis tools, the SJ300E is a complete solution.

Jitter and wander can cause severe problems in SDH and SONET systems. The SJ300E offers complete generation and measurement of phase jitter parameters on SDH/SONET signals up to 622 Mb/s. In addition, it generates and analyzes line and synchronization signal wander in SDH/SONET systems.

NETWORK TEST CAPABILITIES

The SJ300E can also perform network wander tests. This includes sync transient generation, a choice of monitor or terminate levels for measuring sync signals, and a wide choice of sync signal framing patterns. The wander test option (Option 06) includes software for fast analysis and graphical display of Time Deviation/Maximum Time Interval Error (TDEV/MTIE). This PC-based software drastically reduces the time and effort required to do wander analysis.

Characteristics

TRANSMIT AND RECEIVE LINE RATES

STS-1 – 51.84 Mb/s.

STS-3/STM-1e – 155.52 Mb/s.

OC-1 – 51.84 Mb/s.

OC-3/STM-1 – 155.52 Mb/s.

OC-12/STM-12 – 622.08 Mb/s.

PATTERN GENERATION/MEASUREMENT

Generator – Internal 2^7 PRBS or external "through data."

Receiver – A PRBS signal of pattern length 2^7 or a SDH/SONET formatted signal with the payload portion consisting of all zeros or all ones.

JITTER GENERATION

Generator –

Jitter frequency: 1 Hz to 1/125 of baud rate.
Frequency accuracy: ±20 ppm.
Jitter amplitude: Up to 22 UI_{p-p} depending on jitter frequency.
Resolution: 0.01 UI.
Resolution accuracy: ±1%, ±0.01 UI.

TRANSMITTER OUTPUTS

Clock Out –

Frequency: 51.84, 155.52, or 622.08 MHz ±20 ppm.
Level: ECL nominal levels.
Impedance: 50 Ω to –2 V terminated.
Connector: BNC (internal) with external CLOCK OUT. Same frequency as external clock.

Data Out –

Baud rate: Equals frequency of CLOCK OUT, NRZ.
Impedance: 50 Ω to –2 V terminated.
Connector: BNC.

Optical Out –

Baud rate: Equals frequency of CLOCK OUT.
Connector: FC/PC.
Mean output power (EOL): –9 dBm ±3 dBm.
Center wavelength: 1305 nm ±35 nm.
Spectral width (at –3 dB): 5 nm maximum.

Ref Clock Out –

Output: Same as CLOCK out without added jitter.
Amplitude: 0.4 to 1.2 V_{p-p} into 50 Ω.
Impedance: 50 Ω AC-coupled, to ground.
Connector: BNC.

TRANSMITTER INPUTS

Clock In –

Frequency: 51.84, 155.52, or 622.08 MHz ±100 ppm.
Level: ECL nominal levels.
Impedance: 50 Ω or AC-coupled.
Connector: BNC.

Thru Data In –

Level: ECL nominal levels.
Impedance: 50 Ω to –2 V terminated, NRZ.
Connector: BNC.

External Modulation In –

Impedance: 50 Ω terminated to ground.
Connector: BNC connector.
Sensitivity: 0.1 V/UI.
Accuracy: ±5%.
Amplitude limits: ±0.8 V maximum.
Rate-of-change limits:
52 MHz: ±0.135 V/µs.
155 MHz: ±0.405 V/µs.
622 MHz:±1.62 V/µs.

SDH/SONET Analyzers

SJ300E

RECEIVER PEAK-TO-PEAK JITTER

Wide Mode –
Jitter amplitude: Up to 16 UI_{p-p}, depending on the jitter frequency and receiver baud rate.
Resolution: 0.01 UI.
Amplitude accuracy: 52 MHz: ±1%, ±0.01 UI; 155 MHz: ±1%, ±0.02 UI; 622 MHz: ±1%, ±0.03 UI.

Fine Mode –
Frequency response: First-order high-pass filter with cutoff frequencies that depend on receiver baud rate as follows: 52 Mb/s: 14 Hz + 3 Hz; 155 Mb/s: 30 Hz + 10 Hz; 622 Mb/s: 120 Hz + 35 Hz.
Jitter amplitude: Up to 0.6 UI_{p-p}, depending on the jitter frequency and receiver baud rate.
Resolution: 0.001 UI.
Amplitude accuracy: 52 MHz: ±3%, ±0.002 UI; 155 MHz: ±3%, ±0.003 UI; 622 MHz: ±5%, ±0.009 UI.

TRANSFER FUNCTIONS

Range – +3 to –50 dB.

Resolution – 0.01 dB

Note: The maximum jitter amplitude received cannot exceed the maximum receiver input range.

RECEIVER RMS JITTER

Wide Mode –
Frequency response: First-order high-pass filter at the greater of 12 kHz and the selected high-pass filter. Third-order, maximally flat, low-pass filter at 1/125 of the receiver baud rate.
Jitter range: Measures RMS value of jitter that meets the wide mode peak-to-peak jitter tolerance.
Resolution: 0.01 UI.
Amplitude accuracy:
52 MHz: ±3%, ±0.01 UI_{rms}.
155 MHz: ±3%, ±0.01 UI_{rms}.
622 MHz: ±3%, ±0.02 UI_{rms}.

Fine Mode –
Jitter range: Measures RMS value of jitter that meets the peak-to-peak requirements.
Resolution: 0.001 UI_{rms}.
Amplitude accuracy:
52 MHz: ±3%, ±0.001 UI_{rms}.
155 MHz: ±3%, ±0.002 UI_{rms}.
622 MHz: ±5%, ±0.003 UI_{rms}.
Window range: 1 to 99 seconds or infinity.
Resolution: 1 second.
Selectable high-pass filters:
52 Mb/s: 10 Hz, 100 Hz, or 20 kHz.
155 Mb/s: 10 Hz, 500 Hz, or 65 kHz.
622 Mb/s: 10 Hz, 1000 Hz, or 250 kHz.
Threshold range: 0.000 to 16 UI_{p-p}.
Resolution: 0.001 UI_{p-p}.

RECEIVER INPUTS

Clock In –
Rate: 51.84, 155.52, or 622.08 Mb/s ±20 ppm.
Level: ECL nominal levels.
Impedance: 50 Ω terminated to –2 V or AC-coupled.
Connector: BNC.

Data In –
Rate: 51.84, 155.52, or 622.08 Mb/s ±20 ppm.
Level: ECL nominal levels
Impedance: 50 Ω terminated to –2 V, NRZ.
Connector: BNC.

Optical In –
Rate: 51.84, 155.52, or 622.08 Mb/s ±20 ppm.
Connector: FC/PC.
Power: –22 to –5 dBm.
Wavelength: 1200 to 1600 nm.

Ref Clock In –
DS1: 1.544 Mb/s AMI, framed all 1s; Framing: ESF/SF.
E1: 2.048 Mb/s HDB3, framed all 1s;
2 MHz: 2.048 MHz square wave.
Connector: WECO 310 (100 Ω balanced), BNC (75 Ω unbalanced).

RECEIVER OUTPUTS

Ref Clock Out –
Level: 0.4 to 1.2 V_{p-p}, AC-coupled.
Impedance: 50 Ω to ground.
Connector: BNC.

BITS WANDER (OPTION 06)

Frequency Range – 0 to 10 Hz.

Amplitude Range –
MTIE: 99,999 ns.
TDEV: 99,999 ns.

Amplitude Resolution – 1 ns.

Amplitude Accuracy – +5%, +2 ns.

Slew Rate – +80,000 ns/s maximum.

MTIE Observation Time Range –
Internal: 0.1 to 99.9 seconds.
External: 0.02 to 105 seconds.

TDEV Integration Time Range –
Internal: 0.1 to 99 seconds.
External: 0.02 to 1000 seconds.

BITS IN Input – WECO 310 (100 Ω balanced), BNC (75 Ω unbalanced).
DS1: 1.544 Mb/s AMI, framed all 1s.
E1: 2.048 Mb/s HDB3, framed all 1s.
2 MHz: 2.048 MHz square wave.

BITS OUT Output – WECO 310 (100 Ω balanced), BNC (75 Ω unbalanced).
DS1: 1.544 Mb/s AMI, framed all 1s.
E1: 2.048 Mb/s HDB3, framed all 1s.
2 MHz: 2.048 MHz square wave.

POWER

AC Line – 115 V/230 V AC ±10%.

Power Consumption – 100 W maximum.

DIMENSIONS

Height: 6.0 in. x 14.4 in. x 16.5 in.
(152 mm x 366 mm x 419 mm).
Weight: 22 lbs. (10 kg).

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SJ300E
SONET/SDH Jitter/Wander Analyzer.
Opt. 03 – SONET OC-1/3, SDH STM-1 Optical.
Opt. 04 – OC-1/3/12, STM-1/4 Optical
Opt. 06 – DS1, E1, 51-622 MB Wander Test.
Opt. 09 – SC100A Line Code Converter.
Opt. 1M – Rackmount.
Opt. 3C – Replace FC Connectors with SC.
Opt. 4C – Replace FC Connectors with ST.
Opt. 4S – FFT SW Application Diskette.
Opt. 7C – Replace DS1 Connectors with E1 BNC.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

UNIVERSAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

RECOMMENDED ACCESSORIES
Soft Carrying Case for SJ300E – Order 016-1442-00.
Hard Carrying Case for SJ300E – Order 016-1443-00.
Rackmount – Order 016-1462-00.
10 ft. 25-Pin Male-to-Male RS-232 Cable – Order 012-1384-00.
10 ft. 25-Pin Male to 9-Pin Female RS-232 Cable – Order 012-1298-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ATM Analyzer
ATM150

Features

ATM150

- Standard Interfaces Include DS1/DS3, E1/E3
- Operation up to 155 Mb/s
- Optional Interfaces Include 100 Mb/s Fiber (TAXI), 155 Mb/s OC-3c/STM-1
- QoS (Quality of Service)
- Portable, Economical ATM Test Set
- Propagation Delay Measurement
- Mis-inserted Cell Detection
- Transport Overhead and Alarm Testing
- Remote Control
- Constant Bit Rate (CBR) Voice and Video
- Variable Bit Rate (VBR) Data Mixed Traffic Profiles
- 8,192 Different Destinations
- Up to Four VCI/VPI Addresses
- Powerful Traffic Emulation Capabilities
- Tests Conformance to All ITU G703, G.751, G.832, Bellcore TR-TSY-499, and ATM Forum UNI Specifications Version 3.0

Applications

- Factory Conformance and Compliance Testing
- Field Installation and Setup
- Network Testing
- Switch and Network Performance Analysis
- ATM Interface Card Testing, R&D, and Manufacturing
- Traffic Loading

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

CE

See Tektronix on the World Wide Web: http://www.tek.com

ATM150 Cell Generator and Analyzer

The ATM150 offers powerful, real-time, programmable, and portable ATM cell switch and network performance analysis. Particularly effective for verifying the performance of switches and networks under loaded conditions, the economical ATM150 can be used in the field, lab, or manufacturing applications.

ATM offers efficient transport and switching of video, data, and voice traffic across private and public networks. Since ATM is an emerging technology, standards are still in the definition stage. It's critical during this period of change that ATM products and systems be thoroughly tested to ensure proper operation and conformance to current industry specifications. The ATM150 is a powerful, easy-to-use ATM test instrument that will evolve with the standards by virtue of its modular design which allows new physical interfaces, such as DS1, DS3, E1, E3, 100 MB TAXI, STM-1/OC-3c, etc., to be added as standards stabilize.

The ATM150 offers an exceptionally diverse choice of user-selectable cell traffic distributions. These patterns simulate Constant Bit Rate (CBR) voice and video, Variable Bit Rate (VBR) data, and mixed traffic profiles over a range of average and peak bandwidths. Simulated traffic can be used for highly accurate switch and network throughput analysis and benchmarking. The generator can send active cells to 8,192 different destinations. This includes test cells up to four VCI/VPI addresses.

A complete set of alarms and errors is generated and detected by the ATM150.

Characteristics

DS1/DS3 INTERFACE

DS1/DS3 Physical Interface allows ATM150 to generate and analyze cell streams at 44.736 Mb/s or 1.544 Mb/s. Interface can transmit and receive ATM cells within a DS3 frame (either M23 or C-bit) or a DS1 frame (either SF or ESF). These cells can be directly mapped or an IEEE 802.6 Physical Layer Convergence Protocol (PLCP) can be used.

GENERATOR

DS3 Alarm Generation – LOS: Generates all zero output. LOF: Inverts all M and F bits in the DS3 frame. AIS: Inserts a 1010 pattern in the DS3 payload. LCV: Causes one line code violation on the B3ZS code 10 times a second. IDLE: Inserts a 1100 pattern in the DS3 payload. PARITY: M23 mode – all P-bits are inverted. C-bit mode – all parity C-bits are inverted. FERF: Sets X1 and X2 to zero. FEBE: Sets FEBE C-bits to zero.

DS1 Alarm Generation – LOS: Generates all zero output. AIS: Generates unframed all-ones pattern. LOF (Red): Removes all framing. Yellow: Generates framing appropriate yellow alarm.

PLCP Alarm Generation – LOF: Inverts a bit in the A1 and A2 byte. PARITY: Inverts a bit in the P0-P11 bytes. RAI (Yellow): Sets bit 5 in the G1 byte. FEBE: Inserts one FEBE in each frame. B1: Inserts one BIP error in each frame.

Output Timing – Internal or recovered.

DS1 Output – Rates: 1.544 Mb/s ±20 PPM. Encoding: Bipolar. Impedance: 100 Ω. Level: Cross-connect. Connector: WECO 310 compatible.

DS3 Output – Rates: 44.736 Mb/s ±20 PPM. Encoding: Bipolar with Three Zero Suppression (B3ZS). Impedance: 75 Ω. Level: Cross-connect (700 mV). Connector: BNC.

Data Source – Internal or loop-back.

ANALYZER

DS1 Alarm Monitoring – LOS: Detects all zero input. AIS: Detects an unframed all-ones pattern. LOF (COFA): Detects loss or change of framing. Yellow: Generates framing appropriate yellow alarm. CRC-6: Counts CRC-6 errors in ESF mode. Frame Bit: Counts incorrect framing bits. LCV: Counts line code violations.

DS3 Alarm Monitoring – LOS: Detects sequence of ≥175 zeros. LOF: Detects frame alignment changes or cannot be found. AIS: Detects continuous 1010 pattern in DS3 payload. LCV: Detects line code violation in B3ZS encoding. IDLE: Detects continuous 1100 pattern in DS3 payload. PARITY: M23 mode – detects P-bit parity errors. C-bit mode – detects C-bits parity errors. FERF: Detects if X1 and X2 are zero. FEBE: Detects if FEBE C-bits are zero.

ATM Analyzer
ATM150

PLCP Alarm Monitoring – LOF: Detects PLCP frame alignment changes or cannot be found. PARITY: Detects errors in P bytes and A1-A2 bytes. RAI (Yellow): Detects bit 5 in G1 byte. FEBE: Detects FEBE indications. B1: Detects BIP errors.

Cell Delineation Search Parameters – Alpha: Seven incorrect headers to begin a search for new cell alignment. Delta: Six correct headers to declare delineation.

DS1 Input – Rate: 1.544 Mb/s ±100 PPM. Encoding: Bipolar. Impedance: 100 Ω. Level: Cross-connect. Connector: WECO 310 compatible.

DS3 Input – Rate: 44.736 Mb/s ±100 PPM. Encoding: Bipolar with Three Zero Suppression (B3ZS). Impedance: 75 Ω. Level: Cross-connect. Connector: BNC.

E1/E3 INTERFACE

E1/E3 Physical Interface allows the ATM150 to generate and analyze cell streams at 34.368 Mb/s or 2.048 Mb/s. Interface can transmit and receive ATM cells within an E3 frame or an E1 frame. Cells can be directly mapped or an IEEE 802.6 Physical Layer Convergence Protocol (PLCP) can be used.

GENERATOR

E3 Alarm Generation – LOS: Generates all zero output. FRAME: Errors bits in the E3 frame. LCV: Causes one line code violation on the HDB3 code 10 times a second. PARITY: Errors parity bits. FERF: Inserts FERF bit (G.832). RAI: Sets bit 11 of the frame (G.751).

E1 Alarm Generation – LOS: Generates all zero output. AIS: Generates AIS or TS16 AIS. LOF: Removes all framing. Remote: Generates remote alarm or remote multiframe alarm.

PLCP Alarm Generation – LOF: Inverts a bit in the A1 and A2 byte. PARITY: Inverts a bit in the P0 to P11 bytes. RAI (Yellow): Sets bit 5 in the G1 byte. FEBE: Inserts one FEBE in each frame. B1: Inserts one BIP error in each frame.

Output Timing – Internal or recovered.

E1 Output – Rates: 2.048 Mb/s ±20 PPM. Encoding: HDB3. Impedance: 120 Ω. Connector: Siemens 3-Pin.

E3 Output – Rates: 34.368 Mb/s ±20 PPM. Encoding: HDB3. Impedance: 75 Ω. Connector: BNC.

Data Source – Internal or loop-back.

ANALYZER

E1 Alarm Monitoring – LOS: Detects all zero input. AIS: Indicates when AIS or TS 16 AIS exists for 104 ms. OOF: Detects loss or change of framing. RED: Detects 25 intervals of 4 ms with an OOF. CRC: Counts CRC errors. Frame Bit: Counts incorrect framing bits. LCV: Counts line code violations. FEBE: Counts Far End Block Errors.

E3 Alarm Monitoring – LOS: Detects when sequence of ≥32 zeros occurs. OOF: Detects when frame alignment changes or cannot be found. AIS: Detects all ones pattern. LCV: Counts line code violations. PARITY: Counts parity errors. FERF: Detects FERF (G.832). RAI: Detects RAI (G.751). FEBE: Counts FEBE (G.832).

PLCP Alarm Monitoring – LOF: Detects when PLCP frame alignment changes or cannot be found. PARITY: Detects errors in P bytes and A1-A2 bytes. RAI (Yellow): Detects bit 5 in G1 byte. FEBE: Detects FEBE indications. B1: Detects BIP errors.

Cell Delineation Search Parameters – Alpha: Seven incorrect headers to begin a search for new cell alignment. Delta: Six correct headers to declare delineation.

E1 Input – Rate: 2.048 Mb/s ±100 PPM. Encoding: AMI or HDB3. Impedance: 120 Ω. Connector: Siemens 3-Pin.

E3 Input – Rate: 34.368 Mb/s ±100 PPM. Encoding: AMI or HDB3. Impedance: 75 Ω. Connector: BNC.

REMOTE

Interfaces – RS-232, GPIB, and printer ports.

POWER

Line Voltage – 100/120 or 200/220 V AC.

Power Consumption – 150 W maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	203.2	8
Width	355.6	14
Depth	508	20
Weight	**kg**	**lbs.**
Net	13.6	30

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ATM150
ATM Test Set
Includes: DS1/3 and E1/E3).

Opt. 03 – OC-3C/STM-1 1310 nm I/O FC Connectors.

Opt. 05 – 100 MB TAXI Opt. Interface.

Opt. 1M – Rackmount.

Opt. 3C – Replace FC connectors with SC connectors.

Opt. 4C – Replace FC connectors with ST connectors.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

UNIVERSAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

RECOMMENDED ACCESSORIES

Transit Case for Transmitter or Receiver – Order 016-1447-00.

10 ft. 25-Pin Male-to-Male RS-232 Cable – Order 012-1384-00.

Rackmount Kit – Order 016-1464-00.

10 ft. 25-Pin Male to 9-Pin Female RS-232 – Cable Order 012-1298-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

CE

See Tektronix on the World Wide Web: http://www.tek.com

Optical Attenuator
VXOA41

Features

VXOA41

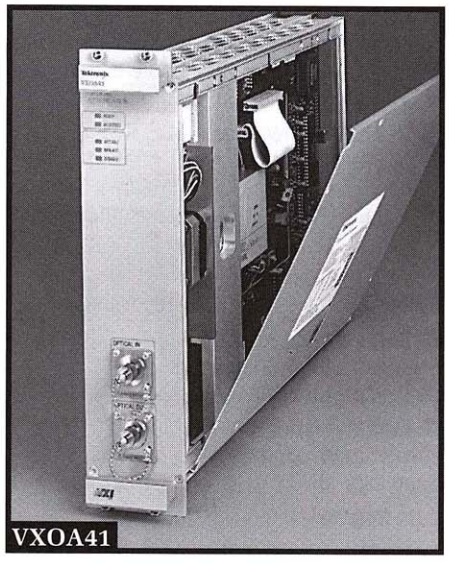
- Singlemode and Multimode Input/Outputs
- Four User Changeable Optical Fiber Connector Type
- Compact Physical Size
- Message Based Control
- "C" Sized Card Configuration

Applications

- Bit Error Attenuation Stress Testing
- Receiver Performance Evaluation
- Fiber Optic Link and System R&D
- OTDR Fiber Attenuation Calibration
- Calibration of Optical Power Meter Linearity
- General Control of Fiber Based Optical Power

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com


VXOA41

VXOA41 Optical Attenuator

The Tektronix VXOA41 optical attenuator is a high-performance instrument used to control the level of optical power propagating through an optical fiber. This product is a plug-in C-sized instrument module for use in a VXIbus System. It provides computer controlled optical attenuation from 0 to 60 dB in 0.01 dB steps.

The VXOA41 accepts input and output signals on connectorized optical fiber cables. The standard version VXOA41 provides for singlemode fiber input and output. Options 01, 02, and 03 provide for the input and output of the three most commonly used multimode fiber sizes (50 µm, 62.5 µm, and 100 µm fiber core diameters).

Technical specifications for the VXOA41 are essentially the same as the Tektronix OA5000 Series GPIB Programmable Optical Attenuators with only minor exceptions.

KEY APPLICATIONS

The VXOA41 products are intended for use in production testing of high-speed fiber optic transmission equipment during its manufacture. Optical receiver sensitivity testing (bit error rate measured as a function of optical signal level) is an important application for this attenuator.

The VXOA41 is a basic functional building block in an all-VXI Tektronix manufacturing test system for SDH/SONET physical layer compliance testing applications. The VXOA41 can also be used as a retrofit module in existing VXI test systems supplied by other manufacturers, as well as those supplied by Tektronix.

TYPICAL CONFIGURATIONS

The VXOA41 is a double-wide VXIbus module. The instrument may therefore be configured with numerous other modules in a VXIbus mainframe, thereby taking advantage of the backplane triggers available. The VXOA41 is often used in conjunction with an optical power meter module and/or a stable optical source. The VXOA41 also may be used in a VXI-based SDH/SONET test system for qualifying SONET transmitters and receivers over their specified dynamic operating range (optical power range). Control of the instrument is accomplished through VXI Message based Communications and with an IEEE 488.2 compliant command set.

FRONT-PANEL INDICATORS

The VXOA41 has five LED indicators on the front panel. Two of these are the standard Tektronix VXIbus indicators: READY and ACCESSED. The other three indicators are specific to the VXOA41: ATT ADJ, MIN ATT, and DISABLE. The user adjusts the various states and settings of the instrument through the command set.

FRONT-PANEL OPTICAL CONNECTORS

The VXOA41 is provided with FC fiber optic connectors installed on the front panel. Users wishing to convert these bulkhead connectors to another type (ST, SC, or DIN-47256) will need to order one Universal Fiber Optic Connector Adapter Kit (020-1885-00) per bulkhead connector that is to be changed. Users who wish to convert both input and output connectors will need to order two Universal Fiber Optic Connector Adapter Kits.

MAINTENANCE

The only routine maintenance required of the user is the cleaning of the optical input and output optical connectors. There is no rigid schedule for the frequency of this maintenance. It depends largely on the cleanliness and frequency of fiber connections and disconnections made to the instrument. It is suggested that any noticeable increase in insertion loss to the instrument is indicative of possible fiber optic connectors which require cleaning.

SELF TEST

Several self-tests are automatically performed on power-up and may also be invoked on command. Circuitry tested includes the CPU and all memory. The VXOA41 supports the IEEE 488.2 defined *TST? and *CAL? commands. Front panel LEDs provide visual indication for instrument

Optical Attenuator
VXOA41

readiness, system controller access, attenuation adjustment, minimum attenuation condition, and shutter status. Instrument parameters and conditions may be read at any time by the system controller.

EQUIPMENT REQUIRED
The VXOA41 is not a standalone instrument and must be used with a VXI C-size Mainframe and VXI Slot 0 controller and/or Resource Manager. Additionally a software utility is needed that is capable of sending and receiving VXI message-based commands and queries to and from a VXI device. A National Instruments LabWindows/CVI driver is shipped with the VXOA41.

Characteristics

OPTICAL

Wavelength Range – 600 nm – 1700 nm (usable wavelengths are > 1100 nm for singlemode).

Input/Output Fiber Type –
Singlemode (standard).
50/125 µm diameter (Option 01).
62.5/125 µm diameter (Option 02).
100/140 µm diameter (Option 03).

Insertion Loss – 2 dB from 1100 – 1600 nm; SM & MM. 4 dB from 700 – 1100 nm; MM only.

Attenuation Range – 60 dB from 700 nm – 1350 nm. 50 dB from 1350 nm – 1600 nm. >100 dB with shutter closed (for standard, Opt. 01, and Opt. 02 versions). > 90dB with shutter closed (for Opt. 03).

Accuracy – MM unit: ±0.15 dB (±0.05 dB typ.) at 850 ±20 nm, 1300 ±20 nm, and 1550 ±20 nm.
SM unit: ±0.15 dB at 1300 ±20 nm, 1550 ±20 nm.
SM unit: ±0.25 dB at other wavelengths.

Linearity – MM units: ±0.05 dB, 600 nm – 1700 nm.
SM Units: ±0.05 dB, 1100 nm – 1700 nm.

Repeatability – ±0.05 dB.

Mode Dependent Loss –
Relative attenuation: ±0.05 dB.
Insertion loss: 0.25 dB (Option 01); 0.35 dB (Opt. 02 and Opt. 03).

Temperature Dependence – ±0.005 dB/°C/db ATT setting; ±0.02 dB/°C (insertion loss). (0 – 50°C relative to 25°C).

Input Return Loss – SM unit: <–45 dB, MM unit: <–25 dB.

Polarization Dependence – <±0.2 dB diff. in throughput attenuation.

Maximum Optical Input – 100 mW (+20 dBm) continuous.

ENVIRONMENTAL

Temperature – Operating: 0°C – 50°C. Nonoperating: –55°C – 60°C.

Altitude – Operating: 4.6 km (15,000 ft.). Nonoperating: 15 km (50,000 ft.).

Humidity – Operating: 90% RH, 0°C – 50°C. Nonoperating: 90% RH, 60°C.

Shock – 60 g's (Ω sine) 11 ms duration, 3 shocks in each direction along 3 major axes, 18 total shocks.

Bench Handling – 12 drops from 45° and/or 4 in.

Transportation Handling – Nonoperating, drops of 36 in. on all edges, faces, corners.

Emissions, EMI (Conducted & Radiated) – FCC Rules and Regulations, Part 15, Subpart J, Class A; VFG 243; CISPR 22. Meets European Community EMC Directive 89/336/EEC for Electromagnetic compatibility.

Susceptibility, EMI – Radiated: IEC 801-3 (3 V/m). Conducted: MIL-461B (1980) CS01, CS02, and CS06).

Susceptibility, ESD – 6 kV maximum ESD discharge applied to operating instrument.

PHYSICAL CHARACTERISTICS

Double-wide, C-size module

Dimensions, Overall	mm	in.
Width	60.66	2.388
Height	366.70	14.437
Depth	345.03	13.584
Weight	**kg**	**lbs.**
Net	2.4	5.25

POWER REQUIREMENTS*[1]

+24 V – 0.32 A
+12 V – 0.00 A
+5 V – 2.30 A
–2 V – 0.68 A
–5.2 V – 0.05 A
–12 V – 0.00 A
–12 V – 0.04 A

Power Dissipated – 22 W.

Required Cooling –
1.5 liters/sec at 0.04 mm H_2O.

[1] Maximum peak current in amps.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

VXOA41
VXI Programmable Optical Attenuator.
Includes: VXI Optical Attenuation C-sized Plug-in Module with Female FC (installed) Input and Output Optical Bulkhead Connectors; User Manual (070-8777-00); Single Mode| Fiber Input and Output.

Opt. 01 – Substitute 50/125 µm Fiber Input and Output.

Opt. 02 – Substitute 62.5/125 µm Fiber Input and Output.

Opt. 03 – Substitute 100/140 µm Fiber Input and Output.

MEASUREMENT SERVICE OPTIONS

Opt. IN – Product Installation Service.

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R5 – Repair warranty extended to cover five years.

Opt. S3 – Three year upgrade to "On-site" Service.

Opt. S5 – Five year upgrade to "On-site" Service.

OPTIONAL ACCESSORIES

Universal Fiber Optic Connector Adapter Kit – Universal Fiber Optic Connector Kits (020-1885-00) provide the field installable parts necessary to convert VXOA41 front-panel optical bulkhead (female) connectors to ST, SC, or DIN-47256 connectors (FC connectors come installed on instrument). Each kit contains one each ST, SC, and DIN-47256 connector. If both input and output connectors are to be changed, two kits would be needed.

Fiber Optic Cables – Refer to page 339 for complete list.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

Communications Signal Analyzer
CSA 803A

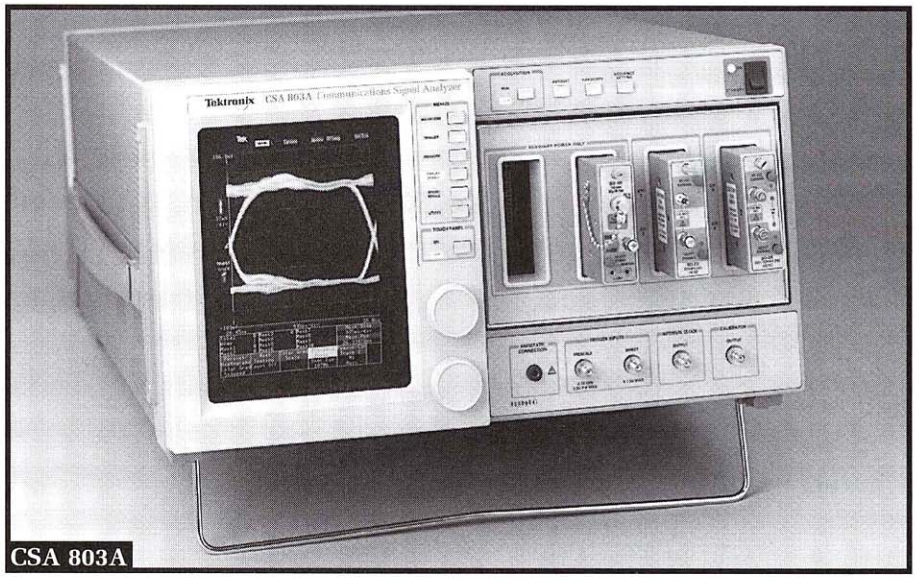
Features

CSA 803A

- DC to 50 GHz Bandwidth
- Automatic Statistical Analysis
- 38 Industry Standard Masks (ITU-T and ANSI)
- High Resolution and Repeatability
- 7 ps Rise Time (SD32)
- Modularity Through Sampling Heads
- Triggering to 10 GHz (Prescaler)
- TDR for Precision Impedance Analysis
- FFT for Spectral Analysis
- Extinction Ratio Measured Automatically
- Built-in Automatic Eye Pattern and Pulse Template Testing

Applications

- Optical Standards Compliance Testing
- Electrical Standards Compliance Testing
- Timing Analysis
- Pass/Fail Mask Measurements for Telecom (SDH/SONET) and Datacomm (FDDI/ Fiberchannel)



CSA 803A

CSA 803A

The CSA 803A communications signal analyzer offers the highest bandwidth and time resolution of the 11000 Series. In addition to the easy-to-use, touch-screen user interface and powerful automatic measurement system common to all 11000 Series instruments, the CSA 803A adds single-ended and differential TDR and TDT, timing resolution to 0.01 ps, and up to 50 GHz bandwidth (depending on the sampling head used). This unmatched performance and feature set makes the unit ideal for semiconductor device testing. TDR characterization of circuit boards, IC packages, cables and high-speed digital communication measurements.

The CSA 803A accepts up to two dual-channel SD Series sampling heads and has built-in trigger capability of up to 10 GHz through the prescaler.

RESOLUTION AND REPEATABILITY
The state-of-the-art digital time base in the CSA 803A provides unmatched timing resolution, with sample intervals to 10 femtoseconds (0.01 ps) and measurement repeatability to 1 ps. In addition, the vertical system provides 8-Bits of vertical resolution at all deflection factors (80 µV LSB at 2 mV/div). Powerful on-board waveform processing allows expansion with averaging to sensitivities in the 100 µV/div range and beyond.

NON-VOLATILE STORAGE
Waveforms, settings and user defined masks are preserved in battery backed-up memory for added convenience.

FAST FOURIER TRANSFORM (FFT)
FFT allows for analysis of both spectral magnitude and phase of acquired waveforms.

FASTEST ACQUISITION
The CSA 803A, with its multiprocessor-based architecture and high-speed analog, error-sample feedback-loop technology, has the highest sample rate of any sampling oscilloscope. The 200 kHz sampling rate gives the CSA 803A a "real time" feel for waveform controls and allows high-speed data capture for histograms and automated measurements.

MODULARITY MAKES ROOM FOR GROWTH
In the Tektronix tradition, the CSA 803A can be tailored through modular plug-in sampling heads for a variety of applications. Modularity also offers a path for growth and expansion as new sampling heads become available. For example, for applications requiring superior noise performance, the SD-22 Sampling Head offers two channels of acquisition at 12.5 GHz with 450 µV (typical) of noise. High bandwidth acquisition and TDR are available in the SD-24 sampling head, which offers two channels with 20 GHz bandwidth and two polarity-selectable TDR step generators. The complete SD Series of sampling heads is listed on page 102.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, RS-232C, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Communications Signal Analyzer
CSA 803A

STATISTICAL MEASUREMENTS
A built-in statistical database allows the instruments to accumulate three-dimensional waveform data-time, voltage, and sample density. The database is a 512 x 256 x 16-Bit data array which accumulates waveform data by counting the number of times each pixel in the display is activated. This information is then displayed in a color-graded format that gives you an instant qualitative view of the acquired waveform. The power of the statistical database is the measurement capabilities – time and voltage histograms and automatic statistical measurements.

COMMUNICATION APPLICATIONS USING THE STATISTICAL DATABASE
Time and voltage histograms are powerful statistical tools for measuring noise and jitter in communication signals. The histograms include useful information such as mean, RMS deviation, and pk-pk, displayed and continuously updated at a user selectable rate. High sample rates make it possible to analyze data concurrent with acquisition rather than in a batch mode later on. The statistical database allows you to change histogram parameters without reacquiring data.

For the first time you can make jitter and noise measurements with one simple selection from an on-screen menu. Controls are provided for adjusting left and right limits, selecting RMS or pk-pk and absolute or relative measurements. For eye diagram measurements you can choose either the eye crossing or the mesial level for jitter measurement location. Either top line or base line can be selected for noise measurements. The CSA does the rest, and displays the jitter and noise measurements in the status menu at the bottom of the screen.

MASK TESTING
For Compliance test to ITU-T and ANSI standards, 38 predefined telecom masks are available by adding Option 1T. The CSA 803A settings are all automatically determined by pressing AUTOSET while the desired mask is displayed. See table for a complete listing of masks.

In addition, you can define and edit up to 10 masks simultaneously. These masks (polygons) may each have up to 50 vertices. The CSA 803A then counts the individual and total samples that fall in each of the defined masks. Once defined the masks can be stored for future use.

Predefined Standard ITU-T and ANSI Eye Pattern and Pulse Masks

ITU-T SDH and ANSI SONET Optical Standards		
OC-1 51.84 Mb/s	OC-3/STM-1 155.52 Mb/s	OC-9 466.56 Mb/s
OC-12/STM-4 622.08 Mb/s	OC-18 933.12 Mb/s	OC-24 1.2442 Gb/s
OC-36 1.8662 GB	OC-48/STM-16 2.4883 Gb/s	
ANSI T1.102 Electrical Standards		
DS1 1.544 Mb/s	DS1 (old) 1.544 Mb/s	DS1C 3.152 Mb/s
DS2 6.312 Mb/s	DS3 44.736 Mb/s	DS4NA 139.26 Mb/s
DS4XNA 139.26 Mb/s	STS1 51.84 Mb/s	STS3 155.52 Mb/s
STSX3 155.52 Mb/s		
ITU-T G.703 Electrical Standards		
Single Pulse 64 Kb/s	Double Pulse 64 Kb/s	Data Pulse 64 Kb/s
Timing Pulse 64 Kb/s	Pulse 1.544 Mb/s	Sym. Pair 2.048 Mb/s
Coax Pair 2.048 Mb/s	Sym. Pair 6.312 Mb/s	Coax Pair 6.312 Mb/s
Pulse 8.448 Mb/s	Coax Pair 32.064 Mb/s	Pulse 34.368 Mb/s
Coax Pair 44.736 Mb/s	Pulse 97.728 Mb/s	Zero Pulse 139.26 Mb/s
One Pulse 139.26 Mb/s	STM1 155.52 Mb/s	CEPT 565 Mb/s
Other Masks		
FDDI 125 Mb/s	User Programmable (default is OC-192/STM-64)	

AUTOMATED MEASUREMENTS MAKE IT EASY
The CSA 803A offers a comprehensive, accurate, and automatic measurement system. Up to six measurements can be displayed on screen at any time, all updated continuously. Any number of measurements may be made over the GPIB or RS-232C interfaces.

You can make automatic jitter and noise measurements using the statistical measurement mode. Statistical measurements allow automatic pulse parameter measurements on random signals such as eye diagrams and allow you to make stable and accurate measurements even in the presence of jitter and noise.

All measurement parameters are user-controllable and measurement levels may be set in relative (i.e., percentage) or absolute terms. Measurements are also fully annotated so there is no question about which part of the waveform is used for making the measurements.

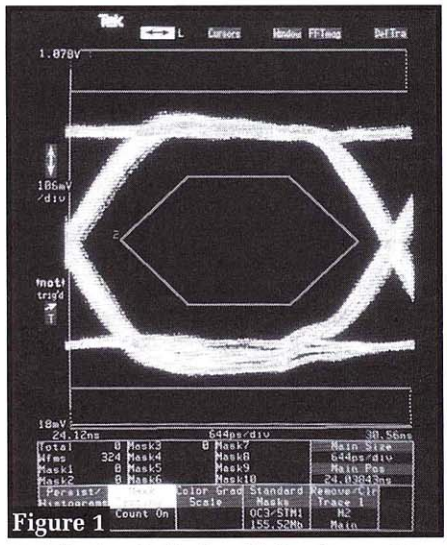


Figure 1

Predefined masks (Option 1T) allow for complete compliance testing without the need for an external computer. See table for a complete mask listing.

Measurements include extinction ratio; amplitude measurements, such as mean, RMS, p-p, and overshoot; timing measurements, such as width, propagation delay, and phase; and energy measurements that provide direct area or energy results! Measurement statistics are also available to evaluate the stability of any measurement result.

ON-BOARD WAVEFORM PROCESSING
The extensive on-board waveform processing capability of the CSA 803A not only provides smooth "real time" update rate and control response, it also allows complex waveform calculations to be performed and displayed in the same continuously updated fashion. Calculated waveforms can be as simple as addition of two channels, or more complex, from basic operators (+, –, x, ÷) to specialized math functions such as square root, differentiate, log, envelope, and filter. Calculations can include acquired waveforms, stored waveforms, and constants.

All measurement functions except hardware measurements are allowed on calculated traces. In addition, the instrument can be set to stop acquisition after certain conditions, such as when a specified number of averages have been completed.

WINDOWING SHOWS THE DETAILS
The CSA 803A offers another first for sampling oscilloscopes – windows. Similar to the delayed sweep on conventional oscilloscopes, windows allow viewing a long interval on one trace while examining the details of a section of the waveform on a second trace.

Communications Signal Analyzer
CSA 803A

Up to seven windows can be created on a single main trace, each with independent positions. The instrument can even be programmed to automatically locate a window on a specified transition within the main waveform. Like the other oscilloscopes in the 11000 Series, windows in the CSA 803A are actually re-acquired with a higher resolution than the main waveform – not just digitally expanded from the main trace, as in some lower performance instruments.

Characteristics

VERTICAL SYSTEM

Rise Time/Bandwidth – Determined by the sampling head used.*1

Vertical Resolution – 8-Bits full screen (80 µV LSB at 2 mV/div deflection factor).

Amplifier Gain Accuracy – ±1% of all settings.

Deflection Factors – 2 to 255 mV/div in 1 mV/div increments.

Offset Range – ±2 V.

HORIZONTAL SYSTEM

Main and Window Time Base – 1 ps/div to 5 ms/div, settable in 1-2-5 sequence or in 1 ps increments.

TIME BASE ACCURACY*2

Time interval	Accuracy
≥ 10 ns	0.01% x time interval + 8 ps
1 ns	10 ps
100 ps	5 ps
10 ps	2 ps

Record Length – 512, 1024, 2048, 4096, and 5120 points.

Windows – Any number of window records may be placed on any number of main records, up to a maximum of 8 displayed traces. All window records have the same duration, but may be independently positioned on any main record. The window may be set to automatically track a moving edge on the main record.

Maximum Sample Rate – 200 kHz.

TRIGGER SYSTEM

Trigger Bandwidth – 3.0 GHz (direct), 2 to 10 GHz (Prescaled).

Trigger Holdoff – Adjustable from 5 µs to 2.5 s.

Trigger Sensitivity*3 – Direct: DC Coupled, 100 mV p-p, DC –3.0 GHz; Prescaled: AC Coupled, 600 mV p-p, AC Coupled: Attenuates signals below 30 kHz.

Delay Jitter (Ext. Trigger) – 2.0 ps (1.3 ps typical) +5 ppm of selected delay (RMS).

Internal Clock – 100 kHz (drives TDR, Internal Clock Output, and Calibrator).

Trigger Input Range – ±1.5 V (direct), ±2.5 V (Prescaled).

MEASUREMENT SYSTEM

Waveform Processing Functions – Add, subtract, multiply, divide, absolute, average, differentiate, envelope, exponent, integrate, natural log, log, signum, square root, smoothing, and filter.

Measurement Set – Max, min, mid, p-p, mean, RMS, amplitude, extinction ratio, overshoot, undershoot, noise*4, rise, fall, frequency, period, prop delay, cross, width, phase, duty cycle, jitter*4, area +, area –, and energy. Measurements are constantly updated; mean and standard deviation available on all measurements.

Measurement Parameters – Proximal, mesial, distal,and start/stop levels: May be set to relative or absolute values.

Cursors – Paired or split dots, vertical bars, and horizontal bars.

POWER REQUIREMENTS

Line-voltage Ranges – 90 to 132 V RMS, 180 to 250 V RMS.

Line Frequency – 48 to 440 Hz.

Maximum Power Consumption – 214 W.

ENVIRONMENTAL AND SAFETY

Operating Temperature – 0°C to 50°C.

Nonoperating Temperature – –40°C to +75°C.

Altitude, Vibration, Shock, Bench Handling – Operating and nonoperating: Meets MIL-T-28800C, Type III, Class 5.

Safety – Listed UL 1244, CSA Bulletin 556B.

Electromagnetic Compatibility – Meets the following requirements of MIL-STD-461C: CE-03 Pt 4 Curve 1, CS-01 Pt 7, CS-02 Pt 4, CS-06 Pt 5, RE-02, Pt 7, RS-01 Pt 4, RS-02 Pt 5, RS-03 Pt 7, (limited to 1 GHz). Meets FCC Part 15, subpart J, Class A.

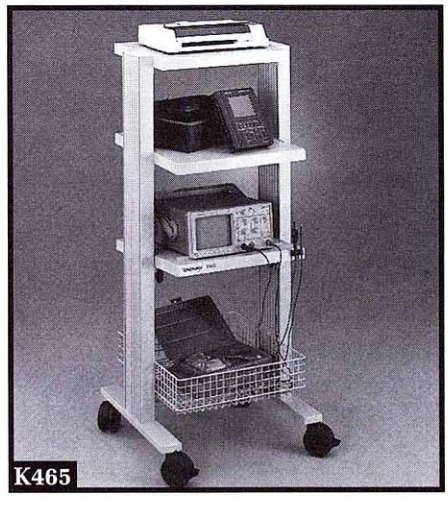
For Germany: Meets VDE 0871/6.78 Class B.

Humidity – To 95% RH at up to 50°C.

PHYSICAL CHARACTERISTICS

	Benchtop		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	599	23.6	550	21.6
Weight ≈	**kg**	**lbs.**	**kg**	**lbs.**
Net	21.8	48	22.7	50
Shipping	31.3	69	32.3	71

**1 See Sampling Head Characteristics on page 102. The CSA 803A mainframe has no acquisition bandwidth limits.*
**2 Interpolate linearly between cardinal points.*
**3 CSA 803A has external trigger only; requires >23 ns pretrigger or use of DL-11 Delay Lines to view trigger point.*
**4 Available only in statistical measurement mode.*



Accessory

K465

Instrument Cart

- Ergonomic design
- Simple height, angle, and shelf adjustments
- Durable steel and aluminum construction
- Large diameter smooth rolling casters
- Nylon safety straps included

Communications Signal Analyzer

CSA 803A

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CSA 803A
Communications Signal Analyzer.
Includes: Tutorial Manual (070-7718-00), User Reference (070-7719-00), Command Reference (070-7720-01), Programmer Reference (070-7738-01), Service Reference (070-7721-00), 12 in. SMA-SMA Cable, 2 ea. 8.5 in. SMA-SMA Cable, 1 Wrist Strap, Power Cord, U.S., Power Cord, U.S., 120 V (161-0066-00).

Opt. 1R – Rackmount.

Opt. 10 – Deletes the 10 GHz prescaler trigger capability. This does not affect the 3.0 GHz trigger.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.
See General Customer Information Section for additional description.

SOFTWARE
See Software Section for selection guide and complete description of software available in the oscilloscope reference section.

MEASUREMENT SERVICE OPTIONS
Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

SD-14
High Impedance Probe Sampler 3 GHz.
Includes: Installation/User Manual (070-8286-00); Service Manual (070-8285-00); 4-post ECB Mount Ground Socket; Edge Tab Ground Socket; 10 ea. Wire-Form Ground, .050 Spacing; 10 ea. Wire-Form Ground, .040 Spacing; Plastic Accessories Case.

SD-20
Loopthrough Sampling Head 20 GHz.
Includes: Installation/User Reference (070-7531-00), Service Reference (070-7528-00), Precision 3.5 mm Termination (011-0155-00), 2 SMA Short-circuit Terminations (015-1020-00).

SD-24
Dual TDR/Sampling Head 20 GHz.
Includes: Installation/User Reference (070-7052-00), Service Reference (070-7053-00), 2 SMA Short-circuit Terminations (015-1020-00).

SD-26
Dual Sampling Head 20 GHz.
Includes: Installation/User Reference (070-7226-01), Service Reference (070-7227-01), 2 SMA Short-circuit Terminations (015-1020-00).

SD-22
Low-noise Sampling Head 12.5 GHz.
Includes: Installation/User Reference (070-7226-01), Service Reference (070-7227-01), 2 SMA Short-circuit Terminations (015-1020-00).

SD-32
Sampling Head 50 GHz.
Includes: Installation/User Reference (070-8268-00), Service Reference (070-8269-00), 1 SMA Short-circuit Termination (015-1020-00).

SD-42
Optical-to-Electrical Converter 6.4 GHz.

SD-46
Optical-to-Electrical Converter 20 GHz.

RECOMMENDED ACCESSORIES – Also see page 438.

PROBES

LOW-Z-PROBES (50 Ω INPUT)
10X, DC – 9.0 GHz. Order P6150.

ACTIVE PROBES
(Requires 1103 Power Supply) –
10X, DC – 1.5 GHz, ≥1 MΩ, <1 pF Input Impedance. Order P6245.

10X. DC – 4 GHz, ≥100 kΩ Input Impedance, 0.4 pF. Order P6217.

CART
Order K465.

CALIBRATION STEP GENERATOR
U.S. – Order 067-1338-00.
Universal European – (240 V, 50 Hz). Order 067-1338-01.
UK – (240 V, 50 Hz). Order 067-1338-02.
Australia – (240 V, 50 Hz). Order 067-1338-03.
Switzerland – (240 V, 50 Hz). Order 067-1338-05.
Japan – (100 V, 50-60 Hz). Order 067-1338-06.

ADDITIONAL ACCESSORIES
Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression.

SMA Accessory Kit – Order 020-1693-00.
Includes: 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-Male Adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-Female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (0.312, 6 point).

3.5 mm Accessory Kit –
Order 020-1692-00.
Includes: 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-Male Adapter, 1 ea. Female-to-Female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Terminators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Terminators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Signal Blews (2 ns, Male-to-Male), 2 ea. Signal Cables (500 ps, Male-to-Male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 each Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point).

2X Attenuator –
SMA Male-to-Female. Order 015-1001-00.

5X Attenuator –
SMA Male-to-Female. Order 015-1002-00.

75 Ω to 50 Ω Min. Loss Attenuator –
BNC, AC coupled. Order 011-0112-00.

Power Divider – Order 015-1014-00.

Blank Sampling Head – Order 200-3395-00.

ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz. Aberrations: ±3% max with 100 ps rise time. Order 015-0558-00.

DC Block (Coupling Capacitor) –
BNC. Order 015-0221-00.

Slip-On Connector – Order 015-0553-00.

Connector Savers – SMA. Order 015-0549-00.
APC. Order 015-0552-00.

CABLES AND EXTENDERS
Sampling Head Extender Cables –
(1 m). Order 012-1220-00.
(2 m). Order 012-1221-00.

Acquisition Extender – Order 067-1324-00.

Card Cage Extender – Order 067-1267-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, RS-232C, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Electrical Communication Adapters

New AFTDS • New AMT75

Features

AFTDS DIFFERENTIAL SIGNAL ADAPTER FOR ELECTRICAL COMMUNICATION

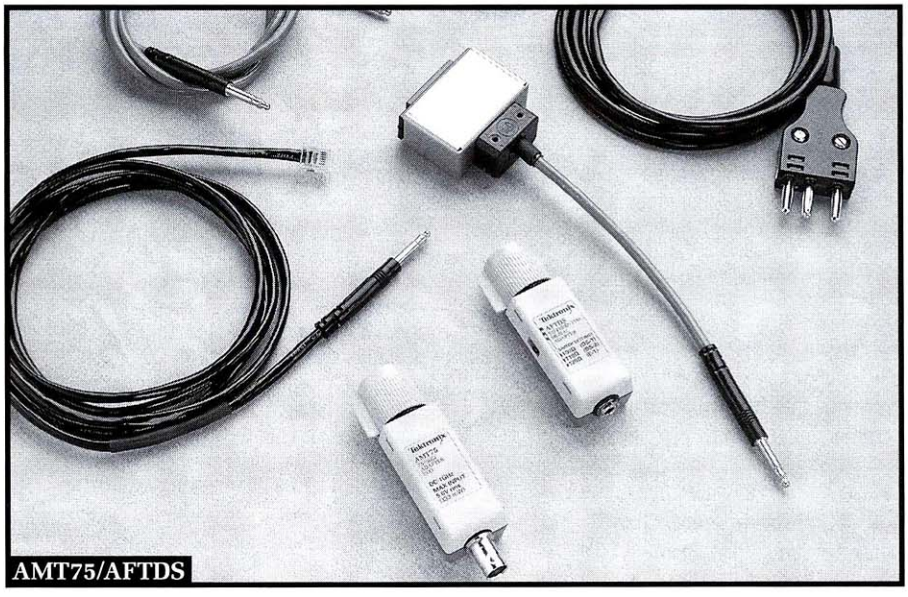
- Complies with ANSI T1.102 and ITU-T G.703 Standards
- 120 MHz Bandwidth
- Low VSWR (Return Loss) < 1.1:1, (> 26 dB)
- Connects Directly to TDS Series Scope (TEKPROBE® Interface) or Other 50 Ω Terminated Instruments
- CE Certified

AMT75 75 Ω ADAPTER FOR ELECTRICAL COMMUNICATION AND VIDEO SIGNALS

- Complies with ANSI T1.102, ITU-T G.957, ITU-T G.703 Standards and Bellcore GR-253-CORE
- 1.0 GHz Bandwidth
- Low VSWR (Return Loss) ≤ 1.1:1, (≥ 26 dB)
- Connects Directly to TDS Series Scope (TEKPROBE® Interface) or Other 50 Ω Terminated Instruments

Applications

- Communication Pulse Shape or Eye Pattern Testing
- Electrical Communication and Video Signal Interface for 50 Ω Terminated Instruments



The AFTDS Differential Signal Adapter and the AMT75 75 Ω Adapter provide an effective means for 50 Ω terminated instruments to connect to and analyze differential and high speed electrical communication signals as well as video signals.

Both adapters are rugged and have the TEKPROBE interface which provides convenient auto-scaling of waveforms on Tektronix TDS series oscilloscopes. Also the low VSWR (Return Loss) performance minimizes measurement errors commonly associated with interfacing with complex electrical signals.

Ideal for use in pulse shape compliance testing of high speed electrical communication signals.

Characteristics

AFTDS DIFFERENTIAL SIGNAL ADAPTER
Electrical Standards –
DS-1: (1.544 Mb/s)
DS-1A: (2.048 Mb/s)
DS-1C: (3.152 Mb/s)
DS-2: (6.312 Mb/s)
E-1: (2.048 Mb/s).

Standards of Compliance – ANSI T1.102, ITU-T G7.03.

Bandwidth (–3 dB) – 7 kHz to 120 MHz.

Rise Time – < 3.0 ns.

Attenuation – 5X, (-14dB) ± 5.0% (valid over 50 kHz to 30 MHz).

Droop – ≤ 2.0 % per 700ns.

VSWR (Return Loss) – ≤ 1.1:1 (> 26 dB), typical (valid over 50 kHz to 30 MHz).

AMT75 75 Ω ADAPTER
Electrical Standards –
DS-3: (44.736 Mb/s)
DS-4: (139.264 Mb/s)
STS-1: (51.84 Mb/s)
STS-3: (155.51 Mb/s)
STM-1: (155.51 Mb/s)
E-2: (8.448 Mb/s)
E-3: (34.368 Mb/s)
E-4: (139.264 Mb/s)
D-1: (270 Mb/s)
D-2: (143 Mb/s).

Standards of Compliance –
ANSI T1.102, ITU-T G.957, ITU-T G7.03, Bellcore GR-253-CORE

Bandwidth (–3dB) – DC to 1.0 GHz (typical).

Rise Time – < 350 ps (typical).

Attenuation – 5X, (–14 dB) ± 2.0%.

VSWR (Return Loss) – ≤ 1.1:1 (≥ 26 dB), up to 1 GHz (typical).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

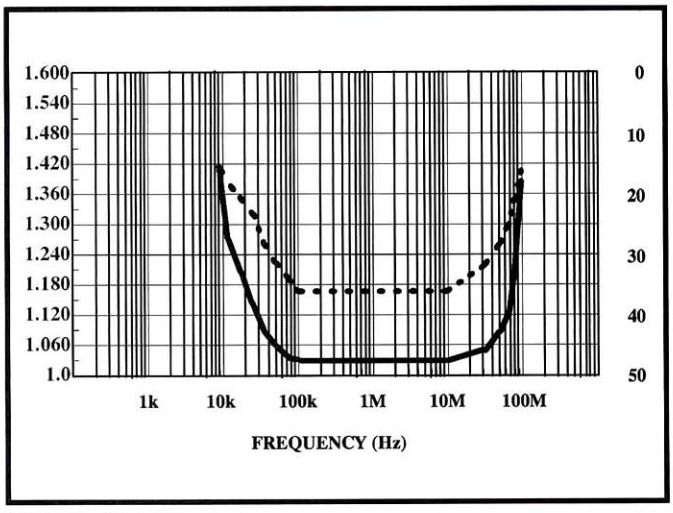
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

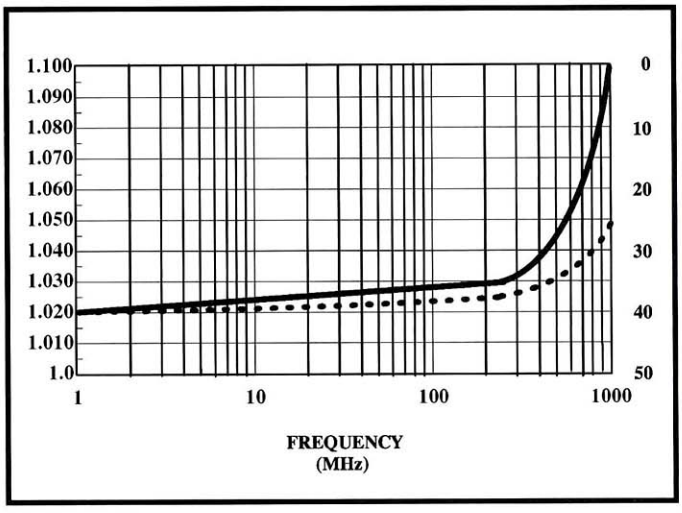
Tektronix Measurement products are manufactured in ISO registered facilities.

Electrical Communication Adapters

AFTDS • AMT75



AFTDS VSWR/Return Loss.



AMT75 VSWR/Return Loss.

AFTDS FEATURES

TEKPROBE® interface – Auto-scaling and auto-termination with Tektronix TDS scopes.

Input Impedance – 100 Ω, 110 Ω, or 120 Ω ± 3.0% (Selectable). (Valid over 50 kHz to 30 MHz).

Load Impedance – 50 Ω ± 3.0%.

Safety – CE, UL (AFTDS only).

AMT75 FEATURES

TEKPROBE® interface – Auto-scaling and auto-termination with Tektronix TDS scopes.

Input Impedance – 75 Ω ± 1.5%.

Output Impedance – 50 Ω ± 1.5%.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

AFTDS

Differential Signal Adapter

Includes: Bantam (M) to Siemens (F) Cable, 5 in. (012-1520-00), Users Manuals (English) (070-9483-00), Certificate of Traceable Calibration.

RECOMMENDED ACCESSORIES

Siemens(M) to Siemens (M) Cable – 2 m (6.5 ft), 120 Ω. Order 012-1469-00.

Bantam (M) to Bantam (M) Cable – 0.9 m (3 ft). Order 012-1522-00.

Bantam (M) to RJ11 (M) Cable – 1.8m (6 ft). Order 012-1521-00.

RJ45/RJ11 (F) to RJ45 (F) Adapter – Order 103-0409-00.

Opt 95 – Calibration Data.

AMT75

75 Ω Signal Adapter

Includes: Users Manuals (English only) (070-9479-00), Certificate of Traceable Calibration.

RECOMMENDED ACCESSORIES

75 Ω, BNC (M) to BNC (M) Coaxial Cable – 2 ft. Order 012-1339-00.

50 Ω, BNC (F) to BNC (F) Feed-through Adapter – Order 103-0028-00)

Opt 95 – Calibration Data.

OPTIONAL ACCESSORIES FOR INSTRUMENT CONNECTIONS

50 Ω, BNC (M) to BNC (F) Coaxial Cable – 18 in., Order 012-0104-00.

50 Ω, BNC Coaxial Terminator Adapter – Order 011-0049-01.

50 Ω, BNC (F) to SMA (M) Adapter – Order 015-0554-00.

RECOMMENDED OSCILLOSCOPES

TDS 500 Series Digitizing Oscilloscopes
TDS 600 Series Digitizing Oscilloscopes
TDS 700 Series Digitizing Oscilloscopes
TDS 800 Series Digitizing Oscilloscopes
11800 Series Digital Sampling Oscilloscopes
CSA 803 Series Communications Signal Analyzer

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Differential Probes

New P6247 • P6246

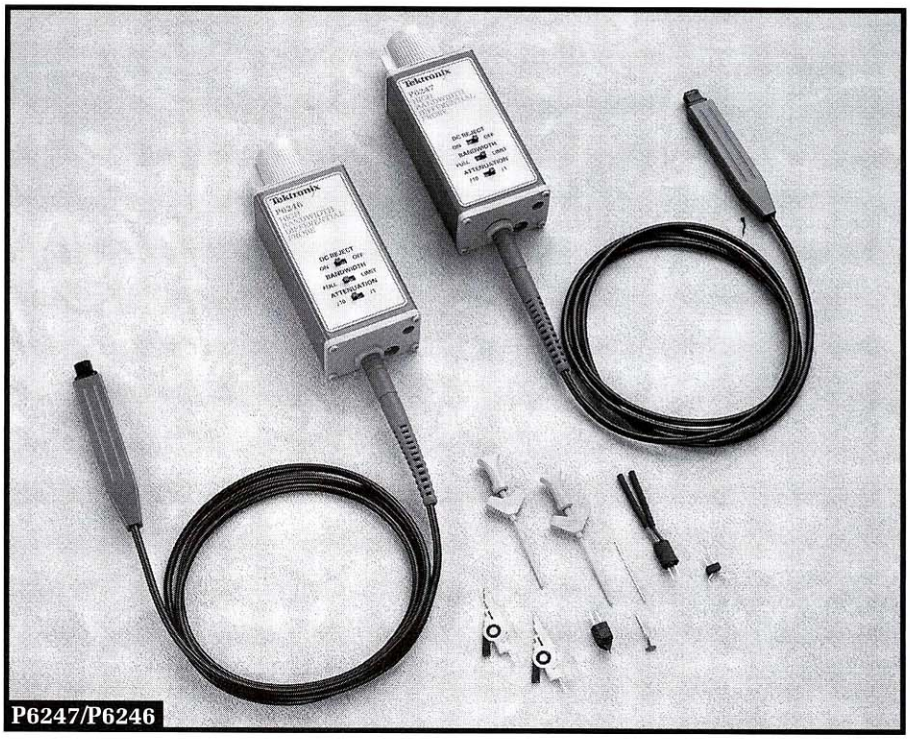
Features

P6247 AND P6246

- >1 GHz/400 MHz Bandwidth
- >70 dB (3160:1) Common Mode Rejection Ratio (CMRR)
- Low Input Capacitance: <1 pF Differential
- Probe Input Connector:Two Standard 0.025 in. (0.1 in. center) Square Pin Receptacle (Female)
- Electrostatic Discharge Tolerant (IEC 801-2)
- Connects to TEKPROBE® Interface on TDS Series Scope, or Other Instruments Using 1103 TEKPROBE Power Supply
- For Use with Oscilloscopes, Spectrum or Network Analyzers, Time Interval Analyzers, and Bit Error Rate Testers

Applications

- Semiconductor Characterization
- Disk Drive Read Channel Design
- Communication Pulse Shape Compliance
- Jitter, Cross-Talk, BERT Measurements
- Location of Ground Bounce



P6247/P6246

The P6246 and P6247 Differential Probes

The P6246 and P6247 enable users to make time domain or frequency domain measurements on high bandwidth signals commonly found in disk drive, digital IC design, and communication applications. The small probe head geometry and assorted probe tip accessories allow these probes to easily accommodate manual probing of surface mount devices while maintaining high CMRR.

The P6246 and P6247 are ideal for design verification of disk drive read channel electronics and timing analysis or for troubleshooting ground bounce problems associated with high speed logic. They can also be used for pulse shape or cross talk compliance testing of high speed communication signals.

Characteristics

WARRANTED SPECIFICATIONS

Bandwidth –
P6247: DC to 1.0 GHz
P6246: DC to 400 MHz.

Rise Time –
<350 ps (P6247), <875 ps (P6246).

Attenuation –
Switchable: ÷1.0, ÷10.0.

DC Attenuation Accuracy – ±2%.

Common Input Voltage Range –
±7.0 V, ÷1; ±7.0 V, ÷10.

Differential Input Voltage Range –
±850 mV, ÷1; ±8.5 V, ÷10.

Max. Non-Destruct Input Voltage –
±25 V (DC + peak AC).

Electrostatic Immunity – >15 kV.

TEKPROBE Interface – Probe power, autoscaling, auto-termination with TDS scopes.

Bandwidth Limit – Switchable, 200 MHz.

DC Reject – 0.4 Hz, ÷1; 4.0 Hz, ÷10.

TYPICAL SPECIFICATIONS

Common Mode Rejection Ratio (CMRR)–
>70 dB at ≤1 MHz
>50 dB at ≤100 MHz
>30 dB at ≤500 MHz
>30 dB at ≤1 GHz.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Differential Probes

New P6247 • P6246

Input C –
<1 pF (differential mode),
<2 pF (common mode).

Input R –
200 kΩ (differential mode),
100 kΩ (common mode).

Linearity – ±2%.

Noise – <50 nV/$\sqrt{Hz}$.

Harmonic Distortion – ≤1.5% @ 100 MHz.

Passband Ripple – <±0.25 dB.
P6247: DC to 850 MHz.
P6246: DC to 400 MHz.

Output Termination –
Terminate into 50 Ω.

PHYSICAL CHARACTERISTICS

Weight (probe only) – 160 g (0.36 lb).

Probe Head Volume – 6 cm^3 (0.3 $in.^3$).

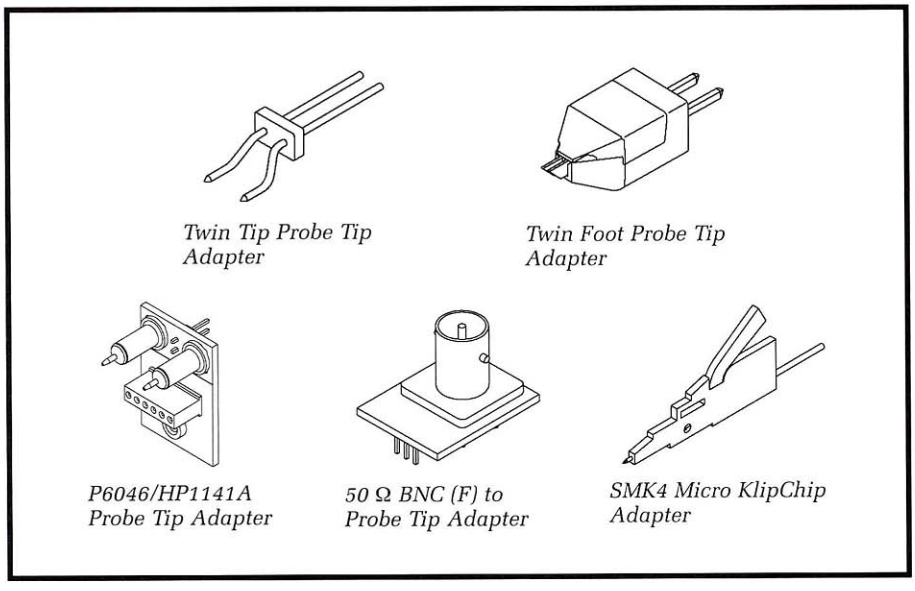
Probe Head Input Connection – 0.63 mm (0.025 in.) square pins on 2.54 mm (0.1 in.) centers.

Output Cable Length – 1.2 m (4.0 ft.).

ENVIRONMENTAL CHARACTERISTICS

Temperature –
Operating 0 to 60°C.
Non-operating –55 to +75°C.

Humidity (0 to 90% RH) –
Operating 30 to 50°C.
Non-operating 30 to 60°C.



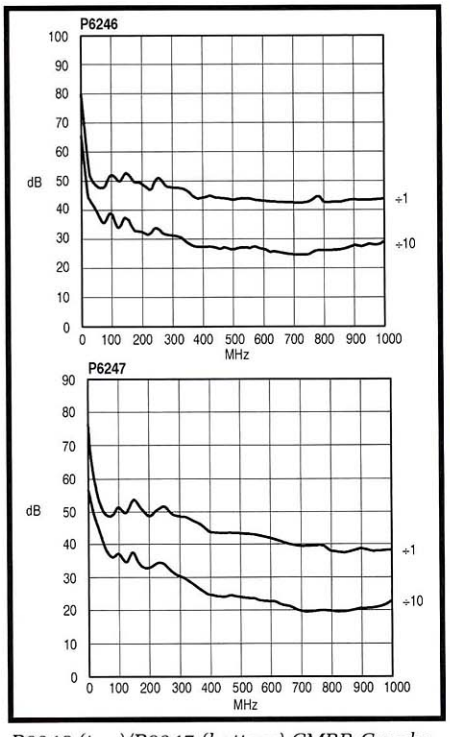
Twin Tip Probe Tip Adapter

Twin Foot Probe Tip Adapter

P6046/HP1141A Probe Tip Adapter

50 Ω BNC (F) to Probe Tip Adapter

SMK4 Micro KlipChip Adapter



P6246 (top)/P6247 (bottom) CMRR Graphs.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6247
Differential Probe

P6246
Differential Probe

Both Include: P6247/P6246 Probe Tip Accessory Kit (020-2203-00), 6 in. ground lead, spring-loaded ground pin (2 ea.), short ground contact (2 ea.), twin tip adapter (2 ea.), twin foot adapter (2 ea.), SMT KlipChip Adapter (3 ea.), Micro KlipChip Adapter (2 ea.), probe tip to BNC adapter, Y-lead adapter.

Hard Case – P6247 Order 006-7340-00, P6246 Order 016-0156-03.

Certificate of Traceable Calibration

User Manual Set –
English, German, French, and Japanese. Order 070-9898-00.
English. Order 070-9899-00.

MEASUREMENT SERVICE OPTIONS

Opt. 95 – Calibration Data.

Opt. R3 – 3 Years Extended Warranty.

Opt. C3 – 3 Years Calibration Services.

RECOMMENDED/REPLACEMENT ACCESSORIES

Probe Tip Accessory Kit – Order 020-2203-00.

Twin Tip Probe Tip Adapters – 4 each. Order 013-0305-04.

Twin Foot Probe Tip Adapters – 4 each. Order 013-0306-04.

SMK4 Micro KlipChip™ Adapters – 4 each.

P6046/HP1141A Probe Tip Adapter – Order 013-0304-00.

50 Ω, BNC (M) to BNC (M) Coaxial Cable – 18 in. Order 012-0076-00.

50 Ω, BNC Coaxial Terminator – Order 011-0049-01.

50 Ω, SMA (F) to BNC (M) Adapter – 015-0572-00.

RELATED PRODUCT

1103 – TEKPROBE® Power Supply w/ standard North America/Japan Power Cord. (See page 456).

Opt. A1 – Europe Power Cord.

Opt. A2 – UK Power Cord.

Opt. A3 – Australia Power Cord.

Opt. A4 – Switzerland Power Cord.

Opt. A6 – Japanese Power Cord.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical-to-Electrical Converters

New P6700 Series

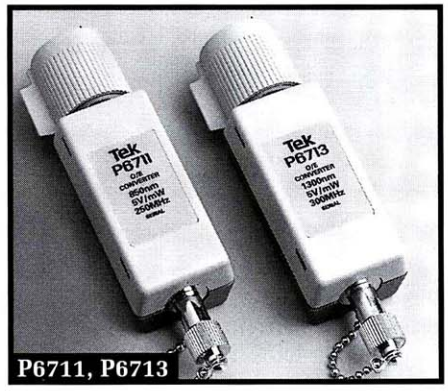
Features

- Broad Wavelength Response 500 to 950 nm or 1100 to 1700 nm
- High Bandwidth DC Up to 1.2 GHz
- High Gain 1 V/mW
- Low Noise ≤11 pW/Hz
- 0 to –35 dBm Dynamic Range
- Probe Connects Directly to TDS Series Scope (TEKPROBE®) or Other 50 Ω Instruments with 1103 TEKPROBE® Power Supply
- SONET/SDH and Fibre Channel Reference Receiver Performance: TDS 500C/700C (Option 3C or 4C) P6701B: Fibre Channel up to 1063 Mb/s, P6703B: SONET/SDH up to 622 Mb/s

Applications

- Eye-Pattern Testing of Optical Communication Signals (SONET/SDH and Fibre Channel)

New P6701B, P6703B, P6723



P6711, P6713

The Tektronix P6700 Series optical-to-electrical (O/E) converters change optical signals into electrical signals for convenient analysis on Tektronix TDS Series oscilloscopes equipped with the TEKPROBE® interface, or any other oscilloscope when used with the 1103 TEKPROBE® power supply. The P6700 Series O/E converters are ideal for optical source characterization in the development, manufacture, or service of optical communication systems and devices.

Small, conveniently packaged P6701B and P6703B optical-to-electrical analog converters provide an accurate interface for optical pulse shape measurements. The high gain, large dynamic range, and stable output offset of these O/E converters make them ideal for performing eye-pattern analysis and extinction measurements.

The P6723 optical logic probe provides a digital conversion of up to 650 Mb/s, NRZ optical signals and converts the data stream into a constant amplitude electrical 1 V pulse train. The P6723 has a sensitivity range similar to standard SONET/SDH optical receivers. It can be used as an optical interface to an electrical clock recovery circuit in support of data stream triggering or to a Bit Error Rate Tester (BERT). The LED on the P6723 indicates a valid optical input signal.

The P6701B/P6703B/P6723 optical input is a one meter, 62.5 µm multimode fiber with an FC/PC connector. Using the standard assortment of hybrid fiber optic mating sleeves, these O/Es can accommodate the various industry connector standards.

The TEKPROBE® interface provides power, auto-scaling, auto-termination, and correct units (microwatts) when used with Tektronix TDS Series oscilloscopes.

SONET/SDH AND FIBRE CHANNEL REFERENCE RECEIVER PERFORMANCE

The P6701B and P6703B can be transformed into ITU G.957 or ANSI FC-PH reference receivers when they are either ordered as an option (3C – P6701B, 4C – P6703B) to the latest Tektronix TDS 500C/700C Series digitizing oscilloscopes or as a standalone hardware solution (nominal).

The TDS Option 3C provides a calibrated P6701B reference receiver for Fibre Channel dates rates from 133 Mb/s up to 1063 Mb/s. Option 4C provides a calibrated P6703B reference receiver for SONET/SDH dates rates from 52 Mb/s up to 622 Mb/s. The optical-to-electrical convertors are matched and calibrated to a specific scope channel which ensures complete system compliance with the fourth-order Bessel-Thompson frequency response.

The P6703B, when used in conjunction with the FS52, FS156, or FS622 SONET/SDH hardware filters, provide customers with a nominal reference receiver performance for 51.84 Mb/s, 155.52 Mb/s, and 622 Mb/s.

The standard P6701B has a nominal frequency response which follows the fourth-order Bessel-Thompson for Fibre Channel 1063 Mb/s. The 1103 TEKPROBE® power supply can be used to connect these products to the 11800 Series or CSA803 Series sampling scopes.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

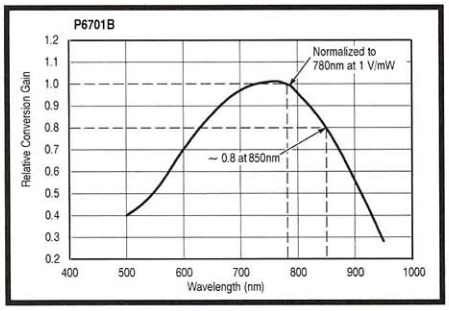
Optical-to-Electrical Converters

New P6700 Series

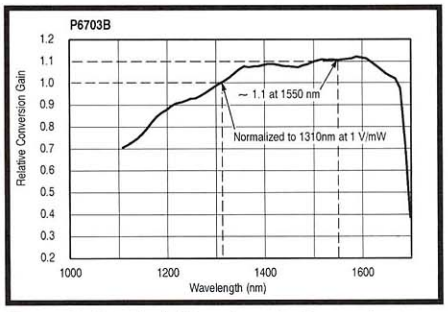
CHARACTERISTICS

	P6701B	P6703B	P6723	P6711	P6713
Wavelength Response	500 to 950 nm	1100 to 1700 nm	1310/1550 nm	500 to 950 nm	1100 to 1700 nm
Bandwidth*1 (typical)	DC to 1.0 GHz (1.1 GHz)	DC to 1.2 GHz (1.4 GHz)	20 to 650 Mb/s	DC to 250 MHz	DC to 300 MHz
Rise Time (typical)	≤495 ps (≤430 ps)	≤395 ps (≤340 ps)	≤455 ps	≤2 ns	≤1.6 ns
Conversion Gain	1 V/mW	1 V/mW	1.0 V_{P-P}	5 V/mW	5 V/mW
Max. Input Optical Power	1 mW (0 dBm)*2 10 mW (10 dBm)*3 20 mW (13 dBm)*4	1 mW (0 dBm)*2 10 mW (10 dBm)*3 20 mW (13 dBm)*4	0.2 mW (–7 dBm)*2 – –	0.2 mW (–7 dBm)*2 10 mW (10 dBm)*3 20 mW (13 dBm)*4	0.2 mW (–7 dBm)*2 10 mW (10 dBm)*3 20 mW (13 dBm)*4
Dynamic Range	0 to –31 dBm	0 to –35 dBm	–8 to –28 dBm	–7 to –37 dB	–7 to –37 dB
Noise Equivalent Power	≤0.75 µW (RMS)*5 ≤24 pW√Hz	≤0.35 µW (RMS)*5 ≤11 pW√Hz	N/A	≤250 nW (RMS)	≤200 nW (RMS)
Max. Input Fiber Core Diameter	62.5 µm	62.5 µm	62.5 µm	200 µm	100 µm

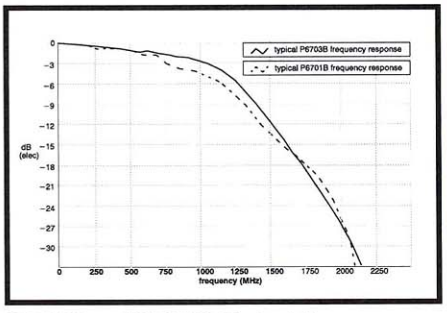
**1 Optical bandwidth (-6 dB electrical)*
**2 Maximum average operating power*
**3 Max average nondestruct*
**4 Max peak nondestruct*
**5 1 GHz low pass filter in series with output*



P6701B: Typical Wavelength Dependent Gain (@ 25°C).



P6703B: Typical Wavelength Dependent Gain (@ 25°C).



P6701B and P6703B: Typical Frequency Response Curves.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6701B
Optical-to-Electrical Converter with FC/PC Connector.
Includes: Hard Case, User Manual (English, French, German, and Japanese), Assorted Fiber Optic Hybrid Connectors (FC/FC, FC/ST, and FC/SC), Certificate of Traceable Calibration.

P6703B
Optical-to-Electrical Converter with FC/PC Connector.
Includes: Hard Case, User Manual (English, French, German, and Japanese), Assorted Fiber Optic Hybrid Connectors (FC/FC, FC/ST, and FC/SC), Certificate of Traceable Calibration.

P6723
Optical Logic Probe with FC/PC Connector.
Includes: Hard Case, User Manual (English, French, German, and Japanese), Assorted Fiber Optic Hybrid Connectors (FC/FC, FC/ST, and FC/SC), Certificate of Traceable Calibration.

P6711/P6713
Optical-to-Electrical Converter(s).
Includes: Option Specified Fiber Optic Input Connector, Hard Case (016-0156-03) and User's Manual (070-8237-00).

Opt. 01 – FC Input Connector.
Opt. 02 – ST Input Connector.
Opt. 03 – DIN 47256 Connector.
Opt. 04 – SMA Connector.
Opt. 05 – SC Connector.

MEASUREMENT SERVICE OPTIONS
Opt. 95 – Calibration Data.
Opt. C3 – Three years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.

AVAILABLE ACCESSORIES
1103 TEKPROBE® Power Supply –
1103 Power Cord Options:
Std – North America/Japan.
Opt. A1 – Europe.
Opt. A2 – UK.
Opt. A3 – Australia.
Opt. A5 – Switzerland.

Single-Mode Fiber Optic Cables –
(9/125 µm, 2 meters)
FC/PC to FC/PC. Order 174-1387-00.
FC/PC to ST. Order 174-1386-00.
FC/PC to Biconic. Order 174-1388-00.
FC/PC to Diamond (2.5). Order 174-1497-00.
FC/PC to Diamond (3.5). Order 174-1385-00.

Multimode Fiber Optic Cables –
(62.5/125 µm, 2 meters)
FC/PC to FC/PC. Order 174-2322-00.
FC/PC to SMA. Order 174-2324-00.
FC/PC to Biconic. Order 174-2323-00.

90/10, 3 Port Single-Mode Optical Splitter FC/PC Connectors – Order 174-3737-00.

10 dB, In-Line Single-Mode Optical Attenuator FC/PC Connectors – Order 119-5118-00.

DIN/FC Fiber Optic Hybrid Connector –
Order 020-2209-00.

50 Ω BNC to BNC Coaxial Cable – 2 feet Male-to-male. Order 012-1339-00.

50 Ω BNC to SMA Adapter – Female-to-male. Order 015-0554-00.

50 Ω BNC Terminator – Order 011-0049-01.

FS52 – SONET/SDH OC-1 (52 Mb/s) Hardware Filter.

FS156 – SONET/SDH OC-3 (155 Mb/s) Hardware Filter.

FS622 – SONET/SDH OC-1 (52 Mb/s) Hardware Filter.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Optical-to-Electrical Converter/Power Meter

OCP 5502

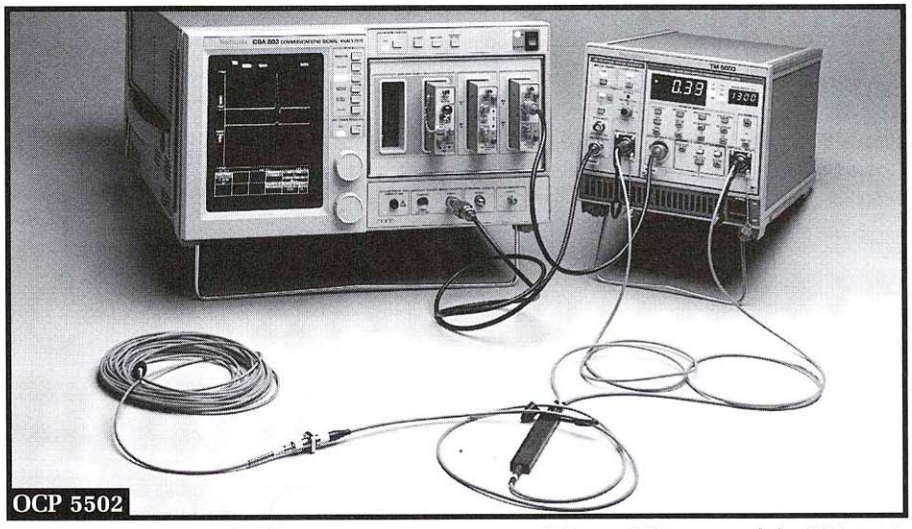
Features

OCP 5502

- DC to 2 GHz Optical-to-Electrical Conversion
- Extremely Low Drift
- Low Equivalent Input Noise
- High Optical Return Loss
- Average Reading Optical Power Meter
- GPIB IEEE 488.2 Controllable
- TEKPROBE® Interface Compatible
- Multiple Optical Connector Types Accommodated
  - FC/PC
  - DIN 47256
  - ST*1
  - SC

Applications

- Accurate Extinction Ratio Measurements
- Optical Eye Pattern Analysis
- LED and Laser Transmitter Characterization
- FDDI and SONET Waveform Standards Verification
- High Sensitivity Optical Reflection Measurements
- High Resolution Optical Reflectometry
- Optical Digital Communication Measurements
- Optical Component Characterization



High Resolution Optical Reflection Measurement using OIG 502, OCP 5502 and the CSA 803A.

OCP 5502 Optical-to-Electrical Converter/Power Meter

The OCP 5000 Series instruments are optical-to-electrical converters with an average reading optical power meter integrated into their design. This combination eliminates the need to use two separate instruments to make parametric measurements on optical signals.

The OCP 5502 is a functionally equivalent instrument, packaged as a standalone, monolithic unit. The OCP 5000 Series instruments can be operated from the front-panel keypad or from a GPIB controller. The GPIB interface meets the IEEE 488.2 standard. The front-panel controls are all matched over the bus and all readings can be communicated over the GPIB interface.

The power meter displays average optical power input in W, dBm and dB. You can set the calibration level to a user defined wavelength (within the 1100 to 1650 nm range) with a simple button push or GPIB command. This feature allows you to use the OCP 5000 Series instruments to design tests and applications that meet your specifications.

In addition to operating with any Tektronix oscilloscope, OCP 5000 Series instruments offer additional functionality when connected with instruments that have a TEKPROBE interface. With the optional TEKPROBE cable, users can read the optical power units directly on the oscilloscope screen.

The Tektronix OCP 5000 Series instruments in the standard configuration are shipped with the "FC" Style optical connector on the input. They are also shipped with field installable front-panel connectors to change the input to either "ST*1," "SC," or "DIN 47256" style connectors. Changing the input connectors is simple and the manual includes clear instructions on how to make this change whenever needed.

OPTICAL REFLECTION TESTS

Optical reflections in fiber optic systems can seriously degrade transmission performance, especially in high-speed communications links using laser sources. Characterization of the reflective performance of optical connectors and components can be crucial to ensuring signal integrity in fiber optic communications equipment.

**1 ST is a registered trademark of AT&T.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Optical-to-Electrical Converter/Power Meter
OCP 5502

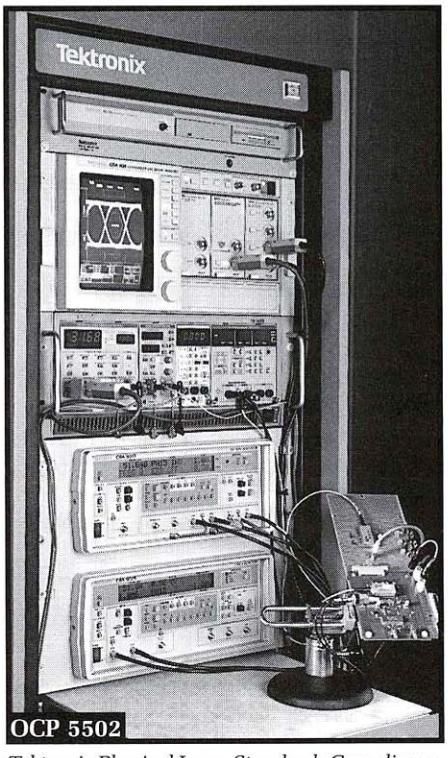
The OCP 5502 can be used with the Tektronix CSA 803A Communication Signal Analyzer or 11801B Oscilloscope and the OIG 502 Optical Impulse Generator to evaluate optical reflections. The return loss of optical reflections can be measured to levels ≤50 dB. Depending on the specific instrument configuration used, multiple reflection events in optical fiber can be spatially resolved to the centimeter range. Single reflection events in optical fiber can be measured down to sub-millimeter accuracy levels.

OPTICAL DIGITAL COMMUNICATION TESTS

The OCP 5502, with its 2 GHz bandwidth, is an excellent optical-to-electrical converter for use in FDDI and SONET compliance testing. When combined with other Tektronix instruments, the OCP 5502 can be used for mask test verification to the FDDI and SONET waveform standards.

The OCP 5502, when coupled with the Tektronix CSA 803A Communication Signal Analyzer, can perform on-board optical eye pattern analysis even at the low signal levels characteristic of LED transmitters.

When the OCP 5502 is coupled with the Tektronix 11801B oscilloscope equipped with the TEKPROBE interface, users can evaluate complex time-domain optical signals to determine the physical layer performance of a fiber optic communication network. Accurate extinction ratio measurements are made possible by the low (<0.5 µW) DC drift of the optical-to-electrical converter when the instrument is in the DC Stable Mode.



Tektronix Physical Layer Standards Compliance Test System for testing to high-speed digital communications standards such as FDDI and SDH/SONET.

The OCP 5502 is used as one of the base optical-to-electrical converters in the Tektronix ORS Series SDH/SONET Reference Receivers. For further information on these Reference Receivers consult the separate entry on these products appearing in this catalog.

OPTICAL COMPONENT CHARACTERIZATION

The combination of an average reading optical power meter and a 2 GHz optical-to-electrical converter in one instrument provides unique benefits when either manual or program control modes are being used. This combination allows users to fulfill most of their optical component characterization requirements with a single instrument. It also allows different tests and multiple test steps to be run without disconnecting and reconnecting optical fiber connectors. This reduces both testing time and cost as well as increases measurement reliability and repeatability.

The OCP 5502 meets or exceeds performance specifications for characterizing many of the latest fiber optic components, such as lasers and LEDs.

CHARACTERISTICS

Optical Converter	OCP 5502
Wavelength Response	1100-1650 nm
Bandwidth	DC-2 GHz*1
Rise Time	260 ps
Conversion Gain	1 V/mW ±8% at 1300 nm
Calibrated Offset	0-1 mW ±1%
Maximum Input Optical Power	2 mW offset at 1 mW 1 mW (no offset)
Noise Equivalent Power	≤1 µW RMS
Optical Power Meter	
Dynamic Range	+7 dBm to –80 dBm
Accuracy*2	≤5% at 1300 nm

**1 –3 dB Optical/–6 dB Electrical.*
**2 With FC/PC connectors.*

Note: For further technical information on the OCP 5000 Series products request Data Sheet #3TW-7671-1.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

OCP 5502
2 GHz Optical Converter/Power Meter.
Includes: Instruction Manual (070-7817-00), Universal Optical Input/Output Connector Kit (020-1885-00).
Opt. 1P – Delete OCP5502 Power Supply.

OPTIONAL ACCESSORIES
Fiber Optic Cables –
Refer to page 339 for complete list.
TEKPROBE® Interface Cable –
Order 012-1372-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

SDH/SONET Reference Receivers

ORS622 • ORS2488

Features

ORS622/ORS2488

- Strict ITU-T G.957 Compliance
- Data Rates Through 2.488 Gbits/s
- Bessel-Thompson Frequency Response
- Accurate Extinction Ratio Measurements
- Low Distortion Eye Pattern and Pulse Measurements
- DC Coupled and Stabilized Amplification
- Convenient and Flexible Configurations
- Measures Average Optical Power
- Easy to Use
- Fully GPIB Controllable

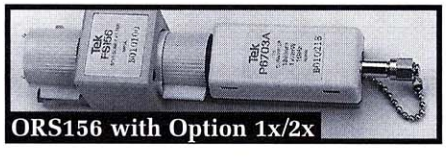
ORS622 with Options 31 and 41

Verifying SDH/SONET System Performance

The Synchronous Data Hierarchy (SDH) and the Synchronous Optical NETwork (SONET) standards are crucial to the next generation of high-speed digital telecommunications systems. The Tektronix ORS Series of optical reference receivers fills a crucial test system gap for verifying SDH/SONET optical system performance.

These are true optical receivers, not just filters. The result is a precision optical reference receiver that can be relied upon to faithfully represent transmitted signals at specific SDH/SONET bit rates for the purpose of waveform or eye pattern analysis. Without an optical reference receiver of this completeness and precision, optical transmitter signal evaluation can become fraught with uncertainties caused by unrelated optical transmitter noise.

In addition to defining optical system signal hierarchy and signal characteristics, SDH/SONET also defines test methodologies and specifications for verifying equipment and system performance. Prominent in this is the use of an SDH/SONET optical reference receiver and an oscilloscope for display and comparison of the data eye pattern to specified masks.



ORS156 with Option 1x/2x

ORS SERIES SPECIFICATIONS

SDH/SONET recommendations define the nominal transfer function for an optical reference receiver as being a fourth-order Bessel-Thompson response. The following table lists the corresponding attenuation at various frequencies, f. In this table f_0 is the receiver's bit rate and f_r is the 3 dB cutoff, which is defined as $f_r = 0.75f_0$.

Allowable deviation from the nominal attenuation in the table is very tightly specified in the SDH/SONET recommendations. The actual allowable deviation values depend on f/f_r and the bit rate. These values run as low as ±0.3 dB.

NOMINAL PERFORMANCE VALUES FOR AN SDH/SONET OPTICAL REFERENCE RECEIVER
(O/E Converter and Filter Together)

f/f_0	f/f_r	Attenuation (dB)	f/f_0	f/f_r	Attenuation (dB)
0.15	0.2	0.1	1.0	1.33	5.7
0.3	0.4	0.4	1.05	1.4	6.4
0.45	0.6	1.0	1.2	1.6	8.5
0.6	0.8	1.9	1.35	1.8	10.9
0.75	1.0	3.0	1.5	2.0	13.4
0.9	1.2	4.5	2.0	2.67	21.5

Each Tektronix ORS Series SDH/SONET Reference Receiver undergoes extensive frequency-response testing. All verification tests are documented. The verification document is supplied as part of the ORS Series SDH/SONET Reference Receiver. This document contains the serial number of the receiver as well as the measured verification data for that receiver.

Receiver selection is based, first of all, on the SDH/SONET bit rate of interest. For greatest flexibility, a receiver based on the OCP5502 O/E converter is recommended even for OC-1 applications. The broad bandwidth of the OCP5502 allows later addition of filters to cover higher bit rates as needed without having to purchase an additional O/E converter. For OC-1 applications requiring economy and high sensitivity, but not requiring flexibility for higher bit rates, a receiver based on the P6713 O/E Converter is recommended. Where economy or coverage of more than one bit rate is the greatest concern, receivers based on the P6703A O/E Converter are the appropriate choice for testing OC-1 and OC-3/STM-1-Bit rates.

The ORS Series SDH/SONET Reference Receivers are TEKPROBE® interface compatible. When used with Tektronix oscilloscopes having the TEKPROBE interface, screen displays will show the proper scale factor for the optical signal (microwatts of optical power). This allows direct measurement and display of results without having to manually apply conversion factors. For oscilloscopes or other instruments not having this TEKPROBE interface, a Tektronix 1103 Power Supply can be ordered separately for ORS Series Reference Receivers using P6703A or P6713 O/E Converters. ORS Series Reference Receivers using the OCP5502 O/E Converter and the ORS2488 are compatible with (but do not require) the TEKPROBE Interface for their operation.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

SDH/SONET Reference Receivers

ORS622 • ORS2488

SELECTION TABLES

Receiver	Option	Configuration	Optical Connectors	Key Benefits
OC-12/STM-4 (622.08 Mbits/s)				
ORS622		OCP5502/FS622 and OC-12 calibration	FC, ST, DIN 47256, and SC	Greatest flexibility. Built-in power meter. GPIB. Multiple bit rate options.
	1P	Delete OCP5502 power supply resulting in TM5000 compatible plug-in instrument	same	Provides compatibility with bench or rackmountable TM5000 Series Modular Instrument Mainframes.
	31	Add FS52 and OC-1 calibration		
	41	Add FS156 and OC-3 calibration		
OC-48/STM-16 (2.488 Gbits/s)				
ORS2488		ORS2488 (includes power supply) and OC-48 calibration	FC, ST, DIN 47256, and SC	Specific to OC-48/STM-16 data rate. Built-in power meter. GPIB.
	1P	Delete OE converter power supply resulting in TM5000 compatible plug-in instrument	same	Provides compatibility with bench or rackmountable TM5000 Series Modular Instrument Mainframes.

**1x=1 (FC Optical Input Connector). x=2 (ST Optical Input Connector). x=3 (DIN 47256 Optical Input Connector). x=4 (SMA Optical Input Connector). x=5 (SC Optical Input Connector). Note: [a]For further technical information on ORS Series products, request Data Sheet #3TW-8530-1. [b]For information on SDH/SONET Reference Receiver calibration services available for new or previously purchased O/E Converters, contact your local Tektronix sales office.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ORS622 – SDH/SONET Receiver.
Includes: OCP5502, FS622 Filter, Calibration Document (063-1266-00), Instruction Manuals (070-8562-00).

Opt. 1P – Delete OCP5502 Power Supply.

Opt. 31 – Add FS52 Filter and OC-1 Calibration.

Opt. 41 – Add FS156 Filter and OC-3/STM-1 Calibration.

ORS2488 – SDH/SONET Receiver.
Includes: Calibration Document (063-1266-0), Instruction Manual (070-8731-00).

Opt. 1P – Delete ORS2488 Power Supply.

MEASUREMENT SERVICE OPTIONS ORS622/ORS2488

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES

Fiber Optic Cables – Refer to page 339 for complete list.

TEKPROBE® Interface Cable – Order 012-1372-00.

TEKPROBE® Power Supply – Order 1103**1*.

**1 For use with oscilloscopes or other signal analysis instruments not having Tektronix TEKPROBE Interface compatibility, the ORS52 and ORS156 Reference Receivers using the P6713 O/E Converters require a Tektronix 1103 Power Supply to be ordered separately.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Optical-to-Electrical Converters

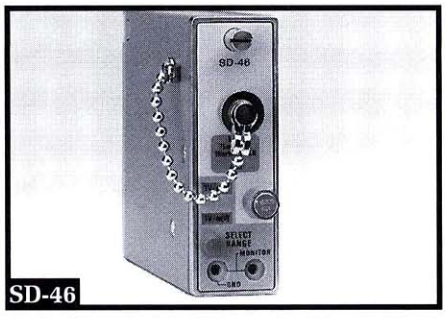
SA-42 • SA-46 • SD-42 • SD-46

Features

- Ultra High Bandwidth
  – DC to 7 GHz (SA-42, SD-42)
  – DC to 20 GHz (SA-46, SD-46)
- Instrument Compatibility
  SD-42/46: 11800/CSA803 Series Sampling Oscilloscopes
  SA-42/46: Any Instrument (Output Connector – "K" Style)
- Power Options
  SD-42/46: 11800/CSA803 Series Sampling Oscilloscopes
  SA-42/46: Standard External Power Supply/Charger, Standard Internal Rechargable Battery, or (Optional) 1101A Tektronix Power Supply
- CE Certified SA-42/46 (Opt. 1E)

Applications

- High Speed Optical Communication Testing (SONET/SDH)
- Optical Source Characterization



Optical-to-Electrical Converter Plug-in Head.

Optical-to-Electrical Converter Module.

SD-42/SD-46

The SD-42/46 are optical-to-electrical converters for use with the Tektronix CSA 803A or 11800 Series sampling oscilloscopes equipped with an SD-22, SD-24, or SD-26 Sampling Head. The optical-to-electrical conversion is linear up to 25 mW peak input with a calibrated deflection factor from 50 µW/div to 5 mW/div/60 µW/div to 6m W/div for optical wavelengths at 1300 nm. These units have a 55 ps/28.5 ps optical impulse response (max. FWHM) with the SD-24 and SD-26 Sampling Heads. The SD-42 has a 60 ps optical impulse response (max. FWHM) with the SD-22 Sampling Head.

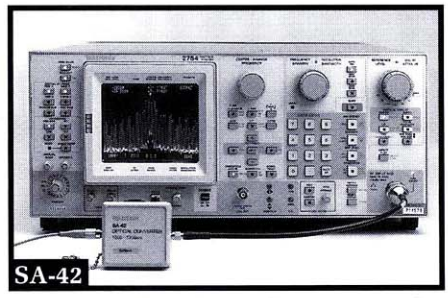
The SD-42 and the SD-46 Optical-to-Electrical Converters can be plugged into the sampling unit or attached by a sampling head extender for remote use. The head extenders come in either 1 meter (012-1220-00) or 2 meter (012-1221-00) options. Refer to page 345 for SD-42 and SD-46 head extenders.

Optical signal input on the SD-42, SD-46, SA-42, and SA-46 is through a standard FC fiber optic connector. Other connector types can be accommodated by using fiber optic jumper cables offered by Tektronix. The SD-42 and the SD-46 also have a mean power meter function with selectable 1 V/nW and 1 V/µW ranges.

SA-42/SA-46

The SA-46 and SA-42 are standalone, wide-bandwidth optical-to-electrical converters packaged as small (palm-sized) compact modules that are easy to use.

The SA-42 and SA-46 Optical-to-Electrical Converters can be used with Tektronix oscilloscopes and spectrum analyzers, as well as with other manufacturers' instruments. These wide-bandwidth optical converters support the analysis of the frequency and time domain characteristics of lightwave modulation in optical fiber based equipment and communications systems.



SA-42 Optical-to-Electrical Converter with Tektronix 2754 Spectrum Analyzer.

Both the SA-42 and SA-46 have an internal battery power source that can be recharged via the battery charger. The SA-42 and SA-46 units have integral battery test indicators to monitor battery status. Each of the units has an FC optical fiber input connector and a female "K" electrical output connector.

TYPICAL APPLICATIONS

Characterization of opto-electronic devices such as laser diodes, light emitting diodes, optical waveguides, optical detectors and electro-optic modulators is becoming more important as applications for fiber optics in telecommunications and data communications expand. The SD-42 and the SA-42 Optical-to-Electrical Converters offer DC to 7 GHz bandwidth performance for wavelengths from 1000 nm to 1700 nm. The SA-46 and SD-46 Optical-to-Electrical Converters give fiber optic equipment developers and researchers optical waveform measurement capability from DC to 20 GHz in the 1200 nm to 1650 nm wavelength range. Measurements such as rise time, aberration, optical power vs. drive current and voltage, modulation bandwidth, and sensitivity can now be made accurately and easily at high bandwidth.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical-to-Electrical Converters

SA-42 • SA-46 • SD-42 • SD-46

The SA-42 or SA-46, combined with a Tektronix oscilloscope or spectrum analyzer, provides convenient optical waveform analysis capabilities. This is useful in the development and characterization of opto-electronic components and modules found in fiber optic transmission networks and fiber optic sensor systems.

CHARACTERISTICS

PULSE CHARACTERISTICS

	SD-42	SD-46	SA-42	SA-46
Impulse Response	55 ps Max (FWHM)	22 ps (FWHM)*1	50 ps Max (FWHM)	22 ps Max (FWHM)
Bandwidth	DC –6.4 GHz Optical	DC –20.0 GHz Optical	DC –7.0 GHz Optical	DC –20.0 GHz Optical
Spectral Response	1000 to 1700 nm	1200 to 1650 nm	1000 to 1700 nm	1100 to 1650 nm
Noise Equivalent Power	23 pW/$\sqrt{\text{Hz}}$ *2 ≤33 µW*3 ≤10 µW*4	32 pW/$\sqrt{\text{Hz}}$ *2 ≤45 µW*3 ≤16 µW*4	23 pW/$\sqrt{\text{Hz}}$ *2	32 pW/$\sqrt{\text{Hz}}$ *2 ≤45 µW*3 ≤16 µW*4
Linear Response Range	≤25 mW Peak Power ≤5 mW Average Power	≤25 mW Peak Power ≤5 mW Average Power	≤25 mW Peak Power ≤5 mW Average Power	≤25 mW Peak Power ≤5 mW Average Power
Aberrations	≤15% p-p*5	≤10% p-p*5	≤15% p-p*5	≤10% p-p*5
Conversion Gain	40 mV/mW	29 mV/mW	40 mV/mW	29 mV/mW
Conversion Factor	25 µW/mV	35 µW/mV	25 µW/mV	35 µW/mV
MEAN OPTICAL POWER MONITOR				
Dynamic Range	5 nW to 5 mW (60 dB)	5 nW to 5 mW (60 dB)	NA	NA
Sensitivity Range 1 Sensitivity Range 2	1 V/mW ±10% 1 V/µW ±10%	1 V/mW ±10% 1 V/µW ±10%	NA	NA
ENVIRONMENTAL				
Operating Temperature Range	0°C to 50°C	0°C to 50°C	0°C to 50°C	0°C to 50°C

**1 Calculated (.44/Optical Bandwidth).*

**2 Root Hertz into 50 Ω.*

**3 System specification with SD-24/SD-26.*

**4 System specification with SD-22.*

**5 Within the first 400 ps following a pulse input.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SD-42
Optical-to-Electrical Converter.

SD-46
Optical-to-Electrical Converter.
Both Include: Red, 2 mm to Banana Lead, 1 m length (012-1286-00), Black, 2 mm to Banana Lead, 1 m length (012-1287-00), 50 Ω Semi-rigid Cable Link (174-1635-00), Instruction Manual (070-8671-00).

MEASUREMENT SERVICE OPTIONS (SD-42/SD-46 ONLY)

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

SA-42
Optical-to-Electrical Converter.
Includes: Instruction Manual (070-7733-00), Power Supply and Charger Unit (119-3716-00), DC Power Cable (174-1966-00), and Power Cable (161-0104-00).

SA-46
Optical-to-Electrical Converter.
Includes: Instruction Manual (070-8047-00), Power Supply and Charger Unit (119-3716-00), DC Power Cable (174-1966-00), and Power Cable (161-0104-00).

MEASUREMENT SERVICE OPTIONS (SA-42/SA-46)

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

INTERNATIONAL POWER PLUG OPTIONS (SA-42 AND SA-46 ONLY)

Opt. A1 – Universal Euro 220 V, 50 Hz. (161-0104-06).

Opt. A2 – United Kingdom 240 V, 50 Hz. (161-0104-07).

Opt. A3 – Australian 240 V, 50 Hz. (161-0104-05).

Opt. A4 – North American 240 V, 60 Hz. (161-0104-08).

Opt. A5 – Switzerland 220 V, 50 Hz. (161-0167-00).

CE CERTIFIED CONFIGURATION

Opt. 1E – Delete Standard Power Supply/Charger.

OTHER RELATED PRODUCTS/ACCESSORIES

Sampling Head Extender Cables –
(1 m). Order 012-1220-00 (SD-42 and SD-46).
(2 m). Order 012-1221-00 (SD-42 and SD-46).

10 kHz to 21 GHz DC Block –
("N" Type). Order 015-0509-00.
(K to "N" Type Adapter). Order 015-0369-00.

See General Customer Information Section for additional description.

1101A Tektronix Power Supply – See page 459.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical Attenuators

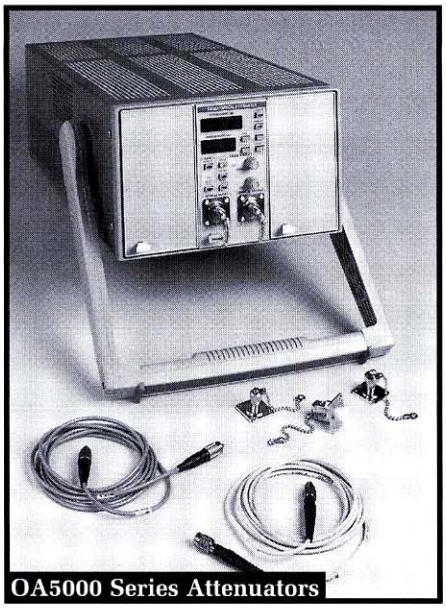
OA5002 • OA5012 • OA5022 • OA5032

Features

- Broad Wavelength Range
  – 750 to 1600 nm
- Supports Multiple Fiber Sizes
  – OA5002 10 µm (Single-mode)
  – OA5012 50 µm (Multimode)
  – OA5022 62.5 µm (Multimode)
  – OA5032 100 µm (Multimode)
- Support Multiple Connector Styles (FC, ST, SC and DIN)
- GPIB, IEEE-488.2 Controllable

Applications

- Evaluate Receiver Sensitivity as a Function of Optical Power
- General Development of Fiber Optic Equipment
- SDH/SONET, Fibre Channel and Ethernet Standards Testing
- OTDR Attenuation Measurement Calibration
- Optical Power Meter Linearity Calibration
- Manufacturing Test of Fiber Optic Equipment



OA5000 Series Attenuators

A Vital Link in Optical Systems Analysis

Tektronix Programmable Optical Attenuators provide a convenient, accurate and cost-effective means of controlling optical power levels in fiber optic media.

The OA5000 Series instruments provide variable attenuation of single and multimode fiber optic signals commonly used in communications equipment. Attenuation levels can be varied manually, using the front-panel controls or automatically via programmable, IEEE-488.2 interface.

The single filter design eliminates measurement dark spots caused by "range changes" and an internal mechanical motion algorithm provides outstanding repeatability.

TYPICAL APPLICATIONS

Communication standards using optical components typically require that the receiver operate over a given optical power range. This specification is tested by monitoring the bit error rate (BER) as a function of optical power.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *The OA5000 Series complies with IEEE Standard 488.2, and with Tektronix Standard Codes and formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Optical Attenuators

OA5002 • OA5012 • OA5022 • OA5032

TRANSMISSION SYSTEM DESIGN

Using the OA5000 Series Optical Attenuators with either the CSA803, 11800 or TDS700C/500C oscilloscopes, network equipment designers can characterize, with repeatable results, the system performance over the specified optical power range.

SDH/SONET COMPLIANCE TESTING

SDH/SONET compliant signal levels may be as high as +2 dBm to as low as –34 dBm. To verify the performance of SONET equipment over these signal levels, it is necessary to have calibrated attenuators with at least this much range. The OA5002 is the attenuator of choice for SDH/SONET testing.

MANUFACTURING AND OTHER AUTOMATED TEST APPLICATIONS

Because the OA5000 Series Optical Attenuators are GPIB Programmable, these units can be operated in a completely automated environment. With the step size of 0.01 dB and a calibrated attenuation range of 0 to 60 dB (continuous), measuring parameters, such as receiver linearity, is quickly and reliably accomplished. Also, with their storable attenuation levels, the OA5000 Series Optical Attenuators are very useful for repeat measurements in manufacturing environments.

CHARACTERISTICS

Wavelength Range		750 to 1600 nm
Fiber Size	OA5002	Single Mode fiber
	OA5012	50 µm Multimode fiber
	OA5022	62.5 µm Multimode fiber
	OA5032	100 µm Multimode fiber
Insertion Loss		≤2.0 dB
Return Loss		≤–45 dB*1 ≤–25 dB*2
Attenuation Range		≥60 dB*3 ≥50 dB*4
Disable		≥100 dB*5 ≥90 dB*5
Accuracy		±0.15 dB (±0.05 dB typ.)
Repeatability		±0.05 dB (±0.02 dB typ.)
Linearity		±0.05 dB
Max. Input Power		+3 dBm (2 µW)
Max. Non-destruct Power		+20 dBm (100 µW) Ave +23 dBm (200 µW) Peak

**1 OA5002.* **4 1350-1600 nm.*

**2 OA5012/OA5022/OA5032.* **5 OA5032.*

**3 750-1350 nm.*

Note: [a]For further technical information request Product Data Sheet #3TW-8032-1. [b]For information on OA5000 Series compatibility with other fiber sizes, contact your local Tektronix sales office.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative,inside the U.S. see the price list in the back of this catalog.

OA5002
Optical Attenuator.
Includes: Single Mode Input and Output.

OA5012
Optical Attenuator.
Includes: 50 Micron Multimode Input and Output.

OA5022
Optical Attenuator.
Includes: 62.5 Micron Multimode Input and Output.

OA5032
Optical Attenuator.
Includes: 100 Micron Multimode Input and Output.

All include: OCP5502 Mainframe (PN 620-0057-00) Two Blank Plug-in Panels (PN 016-0195-05); Universal Optical Input and Output Connector Kit (020-1885-00); Instruction Manual (070-7612-0).

MEASUREMENT SERVICE OPTIONS OA5022 ONLY

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

OPTIONAL ACCESSORIES

Fiber Optic Cables– Refer to page 339 for complete list.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *The OA5000 Series complies with IEEE Standard 488.2, and with Tektronix Standard Codes and formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Bit Error Rate Tester

gigaBERT® GB700

Features

gigaBERT GB700

- Operating Frequency Range 700 Mb/s
- Internal PLL Synthesized Clock Source
- PRBS 2n-1; n = 7, 15, 17, 20, 23
- 128 Kbit Programmable Pattern Memory
- Auto-synchronization
- Clock/Data Delay 4 ns, 20 ps Resolution
- TTL, ECL and PECL I/O Compatible
- Reference Data Input for Proprietary Framed Data
- Pattern Editor (Windows-based) for Custom Word Patterns
- Reference Data Input for Proprietary Framed Data
- Phase Synchronous Clock and Data Edge Tracking
- Supports BURST Mode Operation

Applications

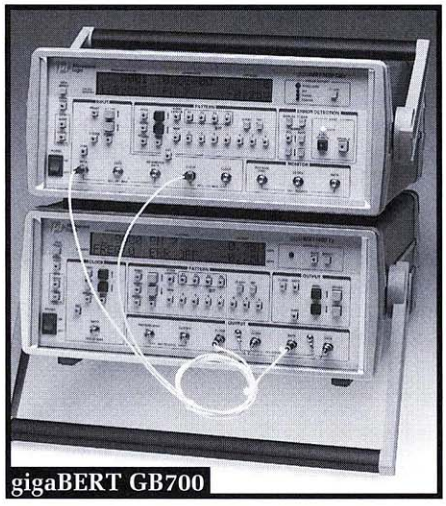
- LAN/SONET/SDH Component Development
- Satellite System Testing
- Digital Transmission System Design
- Fibre Channel Testing
- Uncompressed Digital Video
- High-speed ATM Margin Testing
- Parallel-to-Serial Analysis with MB100

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

CE

See Tektronix on the World Wide Web: http://www.tek.com



gigaBERT GB700 Pattern Generator and Error Detector

The GB700 operates at bit rates up to 700 Mb/s. This instrument is cost-effective for lower-speed applications today and will accommodate your future higher speed requirements as well.

SYMMETRICAL, LOW-JITTER OUTPUT WAVEFORMS

The GB700 generates low-jitter, symmetrical waveforms over its entire operating frequency range. The clock and data ports provide both true and inverted output signals. The instrument can drive single-ended or differential ECL or PECL inputs and also provides levels suitable for TTL inputs.

PRBS OR USER-DEFINED TEST PATTERNS

By generating pseudo-random bit sequences (PRBS) up to 2^{23}–1 bits in length, or user-programmable patterns containing up to 128 Kbits, the user can effectively simulate live traffic or "worst case" patterns. Patterns can be created locally using setup menus or externally by using a workstation or PC. A PC Windows-based Pattern Editor software package comes with the GB700. Externally created patterns can be downloaded via the GPIB or RS-232 port. All user patterns are saved in battery-backed RAM.

ADJUSTABLE INPUTS FOR MAXIMUM FLEXIBILITY

The clock and data ports on the GB700 Error Detector accept both true and inverted inputs. Single-ended or differential signals can be internally terminated. Input data delay is adjustable to accommodate different clock and data signal path delays.

AUTO SEARCH FOR EASY SETUP

Auto search greatly simplifies the Error Detector setup. The GB700 Error Detector automatically synchronizes to the incoming signal by 1) Setting the input data decision voltage to its optimum value; 2) Adjusting input data delay for an optimum clock/data phase relationship; 3) Selecting the correct PRBS test pattern; and 4) selecting the correct pattern polarity (normal or inverted).

Not only will the GB700 Error Detector synchronize with any pattern sourced by a gigaBERT Pattern Generator, it can perform a bit-by-bit comparison and bit error analysis on an arbitrary signal if provided with a known good external Reference data stream.

POWERFUL ANALYSIS AND REPORTING FUNCTIONS

The GB700 performs a full-rate, bit-by-bit analysis of the received signal. Bit error results are then used to calculate three bit error rate (BER) measures. Total BER is calculated from the last power-on or reset. Window BER is calculated over a sliding window specified in terms of time (1 second to 24 hours) or bits 1^{8}- to 1^{16}-Bits). Test BER is calculated from the start of the current test.

Moreover, the GB700 calculates errored seconds (ES), percentage error-free seconds (%EFS), severely-errored seconds (SES), degraded minutes (DM), unavailable seconds (US), and loss of signal (LOS) seconds. All bit error results – including the three BER measures – are calculated simultaneously and may be displayed during a test or after a test has been completed. A hard copy of all test results can be generated locally by connecting a printer to the parallel printer port or GPIB or RS-232 port. Reports may be printed when an error is detected, at the end of test intervals, or both.

Bit Error Rate Tester

gigaBERT® GB700

FRONT PANEL OR AUTOMATED OPERATION
The GB700 provides easy operation augmented by set-up store and recall. Clear, concise LCD displays of setup and results make it easy to use.

The GB700 Pattern Generator and Error Detector can be controlled via the GPIB or RS-232 interface ports. The gigaBERT remote command set includes commands for all setup menus and front panel selections. The status of front panel indicators and test results can be remotely accessed.

BURST MODE
BURST mode, operation allows for operation with non-continuous external clocks. Use of BURST mode requires ECL-level signals with a minimum rate during the burst of 150 KHz. This is a standard feature of the GB700.

Characteristics

PATTERN GENERATOR
Frequency Range –
Internal Clock Source: 150 Kb/s to 700 Mb/s.
External Clock: 150 Kb/s to 705 Mb/s.

Freq. Resolution (Internal Clock) – 1 kHz.

Clock Output Amplitude – 500 mV to 2.0 Vp-p in 50 mV steps.

Clock Output Offset – –2.0 V to 1.0 V in 50 mV steps.

Data Output Amplitude – 500 mV to 2.0 Vp-p in 50 mV steps.

Data Output Offset – –2.0 V to 1.0 V in 50 mV steps

Data Delay Range – ±4 ns.

Data Delay Increments – 20 ps.

Clock Delay – ±4 ns.

Clock Delay Increments – 20 ps.

Std. Programmable Memory – 128 Kbits.

Optional Memory – none.

PRBS Patterns (2^n-1) – 7,15,17,20,23.

Burst Mode (ECL levels only) – Standard Feature

ERROR DETECTOR
Frequency Range With Burst Mode –
150 Kb/s to 700 Kb/s.

Burst Mode (ECL levels only) – Standard Feature.

Clock Input Levels (max) – 500 mV to 6.0 Vp-p.

Clock Input Terminations – GND, AC, –2 V, +3 V.

Clock Input Threshold – –3.00 to +4.5 V in 50 mV steps.

Data Input Level (max) – 500 mV to 6.0 Vp-p.

Data Input Threshold – 3.00 to +4.5 V in 50 mV steps.

Data Input Terminations – GND, AC, –2 V, +3 V.

Single ended or differential operation for clock and data inputs.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.	mm	in.
Height	152	6.0	152	6.0
Width	366	14.4	366	14.4
Depth	340	1304	419	16.5
Weight	**kg.**	**lbs.**	**kg**	**lbs.**
Net	10	22	10	22

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

GB700
700 Mb/s BERT Generator and Detector.
Includes: Power Cord, Manual, and Pattern Editor Software.
Opt. 02 – 75 Ω Term Both Sets.
Opt. 2M – Rack Mount – 2.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

GB700T
700 Mb/s BERT Pattern Generator.
Opt. 02 – 75 Ω Term Pattern Generator Only.
Opt. 1M – Rack Mount.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

GB700R
700 Mb/s BERT Error Detector.
Opt. 02 – 75 Ω Term Error Detector Only.
Opt. 1M – Rack Mount.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

RECOMMENDED ACCESSORIES
Soft Carrying Case – Order 016-1442-00.
Hard Carrying Case – Order 016-1443-00.
Rack Mount – Order 016-1462-00.
10 ft. 25-Pin Male-to-Male RS-232 Cable – Order 012-1384-00.
10 ft. 25-Pin Male to 9-Pin Female RS-232 Cable – Order 012-1298-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

CE

See Tektronix on the World Wide Web: http://www.tek.com

Bit Error Rate Tester

gigaBERT® GB1400

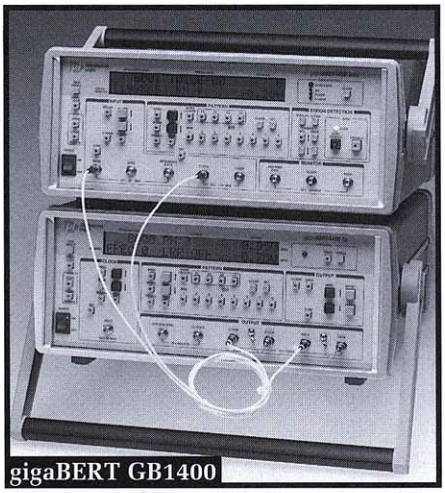
Features

gigaBERT GB1400

- Operating Frequency Range 1400 MHz
- Internal PLL Synthesized Clock Source
- PRBS 2^n–1 n: 7, 15, 17, 20, 23
- 1 Mbit Programmable Pattern Memory (Optional)
- Auto-synchronization
- Clock/Data Delay 4 ns, 5 ps Resolution
- Automatic Eye-width Measurements
- Reference Data Input for Proprietary Framed Data
- Phase Synchronous Clock and Data Edge Tracking
- Optional BURST Mode Operation

Applications

- Gigabit LAN Testing
- Satellite System Testing
- High-speed Circuits and System Design
- Full Rate HDDV Simulation/Testing
- Manufacturing Test in TE Environment
- GaAs, ECL, and Optical Component Testing
- Test Clock Recovery Circuit
- Parallel-to-Serial Analysis with MB100



gigaBERT GB1400 Pattern Generator and Error Detector

The GB1400 operates at bit rates up to 1400 Mb/s. This instrument is cost-effective for lower-speed applications today and will accommodate your future high-speed requirements as well.

SYMMETRICAL, LOW-JITTER OUTPUT WAVEFORMS

The GB1400 generates low-jitter, symmetrical waveforms over its entire operating frequency range. The clock and data ports provide both true and inverted output signals. The instrument can drive single-ended or differential ECL inputs.

PRBS OR USER-DEFINED TEST PATTERNS

The GB1400 can generate pseudo-random bit sequences (PRBS) up to 2^{23}-1 bits and others optional in length, user-programmable patterns. Patterns can be created locally using setup menus or externally by using a workstation or PC. A PC Windows-based Pattern Editor software package comes with the 1M Memory Option. Externally created patterns can be downloaded via the GPIB or RS-232 port. All user patterns are saved in battery-backed RAM.

ADJUSTABLE INPUTS FOR MAXIMUM FLEXIBILITY

The clock and data ports on the GB1400 Error Detector accept both true and inverted inputs. Single-ended or differential signals can be internally terminated. Input data delay is adjustable to accommodate different clock and data signal path delays.

AUTO SEARCH FOR EASY SETUP

Auto search greatly simplifies the Error Detector setup. The GB1400 Error Detector automatically synchronizes to the incoming signal by 1) Setting the input data decision voltage to its optimum value; 2) Adjusting input data delay for an optimum clock/data phase relationship; 3) Selecting the correct PRBS test pattern; and 4) selecting the correct pattern polarity (normal or inverted).

It synchronizes with any pattern sourced by a gigaBERT Pattern Generator. It can perform a bit-by-bit comparison of an arbitrary signal with an external Reference input. Thus the GB1400 can perform bit error analysis on any data pattern with a known good reference pattern.

POWERFUL ANALYSIS AND REPORTING FUNCTIONS

Not only will the GB1400 Error Detector synchronize with any pattern sourced by a gigaBERT Pattern Generator, it can perform a bit-by-bit comparison and bit error analysis on an arbitrary signal if provided with a known good external Reference data stream.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

Bit Error Rate Tester

gigaBERT® GB1400

Moreover, the GB1400 calculates errored seconds (ES), percentage error-free seconds (%EFS), severely-errored seconds (SES), degraded minutes (DM), unavailable seconds (US), and loss of signal (LOS) seconds. All bit error results – including the three BER measures – are calculated simultaneously and may be displayed during a test or after a test has been completed. A hard copy of all test results can be generated locally by connecting a printer to the parallel printer port or GPIB or RS-232 port. Reports may be printed when an error is detected, at the end of test intervals, or both.

FRONT PANEL OR AUTOMATED OPERATION
The GB1400 provides easy operation augmented by set-up store and recall. Clear, concise LCD displays of setup and results make it easy to use.

The 1 MB memory option for both the Pattern Generator and the Error Detector is sufficient for storing and outputting complex data such as SONET frames, ATM cells, MPEG digital video, etc, allowing designers to simulate "live" traffic. The GB1400 Pattern Generator and Error Detector can be controlled via the GPIB or RS-232 interface ports. The gigaBERT remote command set includes commands for all setup menus and front panel selections. The status of front panel indicators and test results can be remotely accessed.

BURST MODE
BURST mode allows for operation with non-continuous external clocks. Use of BURST mode requires ECL-level signals with a minimum rate during the burst of 150 kHz. This is an option on the GB1400.

Characteristics

PATTERN GENERATOR
Frequency Range –
Internal Clock Source: 1 Mb/s to 1400 Mb/s.
External Clock with BURST Mode: 150 Kb/s to 1400 Mb/s.

Freq. Resolution (Internal Clock) – 10 kHz.

Clock Output Amplitude –
500 mV to 2.0 Vp-p in 50 mV steps.
500 mV to 2.8 V with PECL opt.

Clock Output Offset –
–2.0 V to 1.0 V in 50 mV steps.
–2.0 V to 1.8 V with PECL opt.

Data Output Amplitude –
500 mV to 2.0 V in 50 mV steps.
500 mV to 2.8 V with PECL opt.

Data Output Offset –
–2.0 V to 1.0 V in 50 mV steps.
–2.0 V to 1.8 V with PECL opt.

Data delay range – ±4 ns.

Data Delay Increments – 5 ps.

Clock Delay – ±4 ns.

Clock Delay Increments – 5 ps.

Std. Programmable Memory – 16-Bits.

Optional Memory – 1 Mbit.

PRBS Patterns (2^n-1) – 7,15,17,20,23.

Burst Mode (ECL levels only) – Optional.

ERROR DETECTOR
Frequency Range – 1 Mb/s to 1400 Mb/s.
150 Kb/s to 1400 Mb/s (with BURST Mode)

Clock Input Levels (max) –
500 mV to 1.5 Vp-p.

Clock Input Terminations – GND, AC, –2 Vp-p.

Clock Input Threshold – Fixed threshold levels.

Data Input Level (max) – 500 mV to 1.5 Vp-p (does not support PECL).

Data Input Threshold – –1.5 V to 1.0 V in 50 mV steps

Data Input Terminations – GND, AC, –2 V.

Single-ended or differential operation for clock and data inputs.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.	mm	in.
Height	152	6.0	152	6.0
Width	366	14.4	366	14.4
Depth	340	1304	419	16.5
Weight	**kg.**	**lbs.**	**kg**	**lbs.**
Net	10	22	10	22

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

gigaBERT GB1400
1400 Mb/s BERT Generator and Detector.
Not available in Europe.
Includes: Power Cord, Manual.
Opt. 02 – 75 Ω Both Sets.
Opt. 05 – BURST Mode Both Sets.
Opt. 07 – Positive ECL Pattern Generator Only.
Opt. 08 – 1 MEG RAM WORD Both Sets & PC Pattern Editor Software.
Opt. 2M – Rack Mounts – 2.
Opt. A3 – Australian 240 V, 50 Hz.

gB1400T
1400 Mb/s BERT Pattern Generator.
Opt. 02 – 75 Ω Pattern Generator Only.
Opt. 05 – BURST Mode Pattern Generator Only.
Opt. 07 – Positive ECL Pattern Generator Only.
Opt. 08 – 1 MEG RAM WORD, Generator Only with PC Pattern Editor Software.
Opt. 1M – Rack Mount.
Opt. A3 – Australian 240 V, 50 Hz.

gB1400R
1400 Mb/s BERT Error Detector.
Opt. 02 – 75 Ω Error Detector Only.
Opt. 05 – BURST Mode Error Detector Only.
Opt. 08 – 1 MEG RAM WORD, Detector Only with PC Pattern Editor Software.
Opt. 1M – Rack Mount.
Opt. A3 – Australian 240 V, 50 Hz.

RECOMMENDED ACCESSORIES
Soft Carrying Case – Order 016-1442-00.
Hard Carrying Case – Order 016-1443-00.
Rack Mount – Order 016-1462-00.
10 ft. 25-Pin Male-to-Male RS-232 Cable – Order 012-1384-00.
10 ft. 25-Pin Male to 9-Pin Female RS-232 Cable – Order 012-1298-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com

Bit Error Rate Tester

multiBERT™ MB100

Features

multiBERT MB100

- Up to 32-Channels, 110 Mword/s Rate
- Parallel BER (Bit Error Rate) Measurements
- Automatic Synchronization
- 64 Kbits Deep Programmable Memory per Channel
- Error Injection: Single or Multiple Rates
- ±2 ns Delay by 100 ps Step Delay Controls per Channel and Clock Outputs
- Aggregated BER and Each-channel BER Measurements
- Channel Isolation (Mask-off) Function Capability

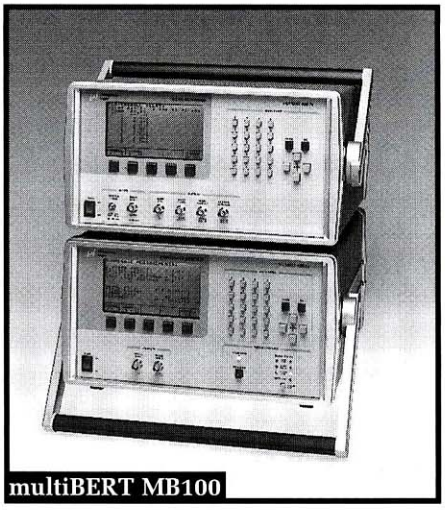
Applications

- Fiber Channel Conformance Testing
- Parallel to Serial Tester
- Bus-oriented Transmission Media Testing
- General Multiplexer/Demultiplexer Testing
- Crosstalk Testing Across Channels
- Stimulus for D/A or encoder testing

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

See Tektronix on the World Wide Web: http://www.tek.com



multiBERT MB100 16 to 32-Channel BERT

The MB100 Analyzer system is a parallel bit-error-rate-tester (BERT). It's designed to be a fully integrated test solution for high reliability bus-oriented subsystems or components requiring low bit error rate performance analysis. It can provide problem isolation for both design and manufacturing.

The MB100 Series includes the Pattern Generator unit, Error Detector unit, ECL-to-TTL Translator, and the TTL-to-ECL Translator. All together, this provides bit parallel pattern generation and error detection with the possibility of either ECL or TTL connection to the device under test.

The MB100 Pattern Generator and MB100 Error Detector are separate, stand-alone instruments which are used together to provide full flexibility in both parallel pattern generation and error detecting. The system is expandable up to 32 channels per unit.

The MB100 Series is an ideal tool to be used in parallel interface circuits. It can also be used in multiplexed data circuits in conjunction with the gigaBERT 1400 Serial BERT Pattern Generator and Error Detector for testing of parallel to serial and serial to parallel devices. The MB100 Pattern Generator and Error Detector may be ordered separately to support testing of circuits and devices where only one side is bit parallel, e.g. testing D/A or A/D converters.

Characteristics

PATTERN GENERATOR

Inputs – External clock inputs: Selectable. CK-IN1: Direct input. Frequency: 50 kHz to 110 MHz maximum; Amplitude: 0.5 to 1 V peak-to-peak; Termination: AC coupled 50 Ω or DC 50 Ω to ground; Connector: BNC, front panel. CK-IN2: Prescaled input. Prescale N: N = 4, 8, 10, 12, 16, 20, 24, and 32; Frequency: 1.4 GHz maximum. Divided clock must be <110 MHz; Amplitude: 0.5 to 1 V peak-to-peak; Termination: AC coupled, 50 Ω; Connector: SMA, front panel.

Clock Outputs –
CK-OUT1: Level: ECL, differential; Rate: Same as data rate. 110 MHz maximum; Delay range: ±2 ns, 100 ps step; Polarity: True or invert, selectable; Connector: AMP 201311-1, 75-Pin connector housing, rear panel.

CK-OUT2: Level: ECL, differential; Rate: One half data rate; Connector: AMP 201311-1, 75-Pin connector housing, rear panel.

CK-OUT3: Level: ECL, single-ended, 50 Ω to –2 V termination; Rate: Same as data rate; Connector: BNC front panel.

CK-OUT4: Level: ECL, single-ended, 50 Ω to –2 V termination. Rate: One half data rate; Connector: BNC front panel.

Pattern Generator –
Number of channels: 16-Channels (24-Channels with Options 20 or 21, 32-Channels with Options 30 or 31).
Data format: NRZ.
Data pattern: Programmable or PRBS $2^n - 1$ (n = 7 and 15).
Pattern length: Programmable, 64 K maximum, 1 word resolution.
Memory size: 64 K deep per channel.
Static pattern storage: Two 64 K individual word patterns, battery-backed.

Error Insertion –
Controls: Error injection can be enabled or disabled on a per-channel basis.
Single error: Selected channel only.
Multiple error: Error rate of 10^{-n} (n = 3, 4, 5, 6, and 7). Error inserted into Enabled channels.

Data Outputs –
Data delay: ±2 ns in 100 ps steps per channel.
Output level: Translator are available as Options 11, 21, and 31. These translator are also available as MB100TT and MB100RT.
Connector: AMP 201311-1, 75-Pin connector housing, rear panel.

Channel Monitor Output –
Selection: Any channel may be selected.
Level: ECL, single-ended, 50 Ω to –2 V termination.
Connector: BNC, front panel.

Word Sync Outputs –
SYNC OUT1: Format: Single-bit wide, one pulse

Bit Error Rate Tester

multiBERT™ MB 100

per pattern frame; Level: 0 to 2 V peak into 50 Ω to ground; Connector: BNC, front panel.

SYNC OUT2: Format: Single-bit wide, one pulse per pattern frame; Level: ECL, single-ended, 50 Ω to –2 V termination; Connector: BNC, rear panel.

Display – 16 x 32 back-lighted LCD.

Interface –
GPIB: Compatible with IEEE 488-2.
RS-232C: DB-25 connector.

Environmental – Operating temperature: +10 to +40°C.

Power –
AC line: 115 V.
Power Consumption: 250 W nominal.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	203.2	8
Width	355.6	14
Depth	431.8	17
Weight	**kg**	**lbs.**
Net	14.5	32

ERROR DETECTOR

Clock Input –
CK-IN1: Frequency: 110 MHz maximum; Level: ECL, differential; Termination: 100 Ω, differential; Delay range: ±2 ns, 100 ps step; Clock phase: Rising edge aligned to data transition, nominal; Polarity: True or invert, selectable; Connector: AMP 201311-1, 75-Pin connector housing, rear panel and 6-foot cable.

Internal Reference Patterns –
Number of channels: 16-Channels (24-Channels with Options 20 or 21, 32-Channels with Options 30 or 31).
Data pattern: Programmable or PRBS $2^n - 1$ (n = 7 and 15).
Pattern length: Programmable, 64 K maximum, 1 word resolution.
Memory size: 64 Kbits deep per channel.
Static pattern storage: Two 64 K individual word patterns, battery backed.

Synchronization Threshold –
Threshold level: Selectable between 256/4096 and 1/65 K in 8 levels.

Measurements –
Average frequency: System word clock frequency, 10 kHz resolution.

Bit error detection: Simultaneous parallel measurements.

Aggregated BER measurements: Total bits received: 0 to 1.6E+19; Total errors: 0 to 999,999,999, 0 to 1.6E+19 (remote read out); Averaged BER: 9.9E–01 to <1.0E–16, Zero error caused BER of (0.0E+00), 0 to 1.6E+19 (remote read out); Other: Elapsed seconds, errored seconds, synchronization loss seconds, and clock loss seconds: 0 to 4,000,000,000.

Per channel measurements: Total bits received: 0 to 1.6E+19; Total errors: 0 to 99,999,999, 0 to 1.6E+19 (remote read out); Average BER: 9.9E–01 to <1.0E–19 (remote read out); Errored seconds: 0 to 4,000,000,000.

Interface –
GPIB: Compatible with IEEE 488-2.
RS-232C: DB-25 connector.

Environmental –
Operating temperature: +10 to +40°C.

Power –
AC line: 115 V.
Power consumption: 250 W nominal.

PHYSICAL CHARACTERISTICS

(MB100T, MB100R)

Dimensions	mm	in.
Height	203.2	8
Width	355.6	14
Depth	431.8	17
Weight	**kg**	**lbs.**
Net	14.5	32

ECL-TO-TTL, TTL-TO-ECL TRANSLATORS (OPT. 11, OPT. 21, OPT. 31)

Inputs/Outputs –
Inputs: Compatible with multiBERT MB100 Pattern Generator.
Connectors: AMP 201311-1, 75-Pin connector housing, rear panel and 6-foot cable (supplied).
Outputs: Data and Clock. Level: 0 to 5 V from 50 Ω source with unterminated load;
Connectors: Sub-miniature SMB (SSMB).
Supplied with 10 each RG178 SSMB – SMA(M) cable assemblies per Translator.

Power – AC line: 115 V.
Power consumption: 50 W nominal.

PHYSICAL CHARACTERISTICS

(MB100TT, MB100RT)

Dimensions	mm	in.
Height	152.4	6
Width	254	10
Depth	254	10
Weight	**kg**	**lbs.**
Net	4.6	10

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

multiBERT MB100
Multi-channel 16-channel single-ended BERT.
Includes: Power Cord, Manual, Extender Cable for Loopback Testing (Device Cables Optional).

MB100T
Multi-channel 16-channel single-ended BERT Transmitter.
Includes: Device Cable.

MB100/MB100T
Opt. 10 – 16-Channel differential.
Opt. 11 – 16-Channel MB100 ECL to TTL translator.
Opt. 20 – 24-Channel single-ended.
Opt. 21 – 24-Channel differential.
Opt. 22 – 24-Channel MB100 ECL to TTL translator.
Opt. 30 – 32-Channel single-ended.
Opt. 31 – 32-Channel MB100 ECL to TTL translator.
Opt. 1M – (MB100T) Rackmount.
Opt. 2M – (MB100) Rackmount.

MB100R
Multi-channel 16-channel single-ended BERT Receiver.
Includes: Device Cable.
Opt. 10 – 16-Channel differential.
Opt. 11 – 16-Channel MB100 TTL to ECL translator.
Opt. 20 – 24-Channel single-ended.
Opt. 21 – 24-Channel differential.
Opt. 22 – 24-Channel MB100 TTL to ECL translator.
Opt. 30 – 32-Channel single-ended.
Opt. 31 – 32-Channel MB100 TTL to ECL translator
Opt. 1M – Rack mount.

MB100TT
Single-ended ECL to TTL translator.
Opt. 11 – 16-Channel MB100 ECL to TTL translators.
Opt. 22 – 24-Channel MB100 ECL to TTL translators.
Opt. 31 – 32-Channel MB100 ECL to TTL translators.

MB100RT
Single-ended TTL to ECL translator.
Opt. 11 – 16-Channel MB100 TTL to ECL translators.
Opt. 22 – 24-Channel MB100 TTL to ECL translators.
Opt. 31 – 32-Channel MB100 TTL to ECL translators.

RECOMMENDED ACCESSORIES
Soft Carrying Case – for Transmitter or Receiver. Order 016-1442-00.

Transit Case – for Transmitter or Receiver. Order 016-1443-00.

Cables –
10 ft. 25-Pin Male-to-Male RS-232 Cable. Order 012-1384-00.
10 ft. 25-Pin Male to 9-Pin Female RS-232 Cable. Order 012-1298-00.
6 ft. Device Cable, 75-Pin AMP Connector (Works with MB100T or MB100R) to label coax leads. Order 012-152X-00

Bit Error Rate Test Set

packetBERT™ PB200

Features

packetBERT PB200

- Packet or Cell BER Testing
- DC to 200 Mb/s Data Rate, NRZ-1
- 256 Kbits Programmable WORD, PRBS, 1's Density, and Selectable Mixed Mode
- Auto Search and Auto Sync Capability
- Controllable Gapped Tx Clock
- Automatic Eye-width Measurement and Extrapolation
- Clock/Data Delay up to 32 ns in 20 ps Increments
- Variable Data/Clock Amplitude and Offset Including ECL, PECL, and High-Z TTL
- Mixed-mode Testing
- Pattern Editor software for Custom Word Patterns (PC Windows-based)

Applications

- Wireless and Satellite Communications
- B-ISDN, Ethernet, TDMA, and CDMA System Design
- Modem Development
- MPEG Frame Generation
- UTP, Fiber Optic Module Development
- Video-on-demand System Development

packetBERT PB200

packetBERT PB200 Packet Generator and Error Detector

The PB200 is particularly suited to packet-based systems. It's ideal for component or sub-system development testing of TDMA, B-ISDN, FITL, ATM, Satellite modems, and similar communications protocols.

The ability to generate a "Mixed Mode" data pattern allows flexibility in constructing many forms of test signals. Two separate programmable word memories of 16 to 256 Kbits in length allow the construction of a packet or cell that can consist of user-definable preamble, overhead, and data. The PB200 data generator has one word memory that is used to define the overhead and preamble, and a second word memory to define the data. Each memory can consist of a user-defined pattern or PRBS. The PB200 can also function as a fully featured non-packetized BERT.

SIGNAL ANALYSIS

For complete flexibility in signal analysis, the PB200 allows BER analysis on all, or only part, of the received digital information. Analysis can be performed on only the overhead, only the data, or both overhead and data at the user's selection.

UNIQUE packetBERT PB200 FEATURES

The PB200 provides several unique features and capabilities that are not found on other BERT products in this class. The receiver has a clock/data deskew range of 32 ns and the ability to measure propagation delay. Along with the Auto Search setup capability, the receiver can automatically measure "eye-width" at user-selectable BERs, and extrapolate BER from data accumulated over much shorter elapsed times than normally required. The transmitter can also generate a gapped clock.

Characteristics

GENERATOR

Clock –

External clock input: Frequency: DC to 200 MHz; Amplitude: 0.5 to 5.0 V p-p; Connector: BNC; Termination select: 50 Ω to –2 V, +3 V, AC or GND; Input range: ECL, TTL, PECL compatible; Threshold resolution: 10 mV step.

External clock reference input: Frequency: 10 MHz, ±100 ppm maximum; Amplitude: 0.5 to 2.0 V p-p, AC coupled; Termination: 50 Ω; Connector: BNC.

Internal synthesized clock source: Frequency: 1 Hz to 200 MHz; Resolution: 1 Hz; Accuracy: 10 ppm.

BURST clock: Programmable gap: 16 Kbits maximum, 8-Bit resolution.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

CE

See Tektronix on the World Wide Web: http://www.tek.com

Bit Error Rate Test Set

packetBERT™ PB200

Pattern Generator –
PRBS: $2^N - 1$, N = 31, 23, 15, 11, 10, 9, 7.

Programmable word: 256 Kbits maximum, 8-Bit resolution.

Mark density: PRBS $2^{10} - 1$ (1/8, 1/4, 1/2, 3/4, 7/8).

Mixed mode frame: 256 Kbits maximum, 8-Bit resolution.

Error injection: Error: Single, Rate, External (TTL); Field select: Overhead, payload, or both; Error rates: Error rate of 10^{-n}, n = 3, 4, 5, 6, 7.

Outputs –
Data and clock outputs: Format: NRZ; Configurations: Differential (True/Complement); Source impedance: 50 Ω; Connector: BNC; Amplitude: 0.5 V to 2.0 V, 10 mV step; Offset, 50 Ω to GND: –2.0 V to +1.8, 10 mV step (termination to 50 Ω will increase the range for PECL); Data delay range: ±1.0 ns, 20 ps resolution; Rise/fall time: 300 ps typical, 500 ps maximum (20 to 80%).

Pattern sync output: Signal level: 250 mV_{p-p} into 50 Ω load.

Auxiliary –
Data inhibit input: ECL, 50 Ω to –2 V, BNC.
Clock disable input: ECL, 50 Ω to –2 V, BNC.

ANALYZER

Data and Clock –
Clock input: External or internal from generator.

Data and clock inputs:
Data polarity: True/invert selectable; Input mode select: Single-ended or differential; Termination select: 50 Ω to –2 V, +3 V, AC or GND; Input range: ECL, TTL, PECL compatible; Threshold resolution: 10 mV step.

Synchronization –
Auto search: Clock and data threshold, Clock and data timing skew, Data pattern and polarity.

Measurements –
Frequency: 1 Hz to 200 MHz.
Bit errors: Window, Totalize, Timed Test, Simultaneous 1's, 0's, and All Errors.
BER test field: Overhead, payload, or both.
Propagation delay: Up to 128 Kbits.
Eye-width: Up to 32 ns.

Reference Data Patterns – Identical to Pattern Generator but independent.
Startup delay: 0 to 64 Kbits programmable.

Auxiliary Signals (BNC Connectors) –
Error count inhibit input: ECL, 50 Ω to –2 V.
Error detect output: RZ, TTL, 50 Ω source.
Analyzer clock disable: ECL, 50 Ω to –2 V.
Data delay output: ECL, 50 Ω source.

COMMON CHARACTERISTICS

Pattern –
Controls: Start/Stop, Pause/Resume, or Single Step.

Save/Load:
Floppy disk: 3.5 in.
Internal storage: 2 Mbits.

Pattern Editor Software requires PC running Windows 3.1 or above.

Remote Interface –
GPIB: IEEE 488.2 compatible.
RS-232C: DB9 connector.
Parallel printer: DB25 connector.
Monitor: DB15, VGA Analog Output.

Environmental –
Operating temperature: 5 to 40°C.
Storage temperature: –10 to 60°C.
Meets European Community EMC Directive 89/336/EEC for electromagnetic compatibility

Power –
AC line: 100 to 120 V AC, 200 to 240 V AC.
Power consumption: 300 W maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	203.2	8
Width	355.6	14
Depth	508	20
Weight	**kg**	**lbs.**
Net	13.6	30

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

packetBERT PB200
Bit Error Rate Test Set.
Includes: Power Cord, Manual (Including Pattern Editor Software Diskette).
Opt. 1M – Rack Mount.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – United Kingdom 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

RECOMMENDED ACCESSORIES

Transit Case for Transmitter or Receiver –
Order 016-1447-00.

10 ft. 25-Pin Male-to-Male RS-232 Cable –
Order 012-1384-00.

10 ft. 25-Pin Male to 9-Pin Female RS-232 Cable –
Order 012-1298-00.

Rack Mount Kit – Order 016-1464-00

Additional Manual – Contact your local Tektronix representative for information.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.2-1987.*

CE

See Tektronix on the World Wide Web: http://www.tek.com

Optical Receiver for RF Spectrum Analyzer
Q32605

Features

- Plug-in for Advantest RF Spectrum Analyzers
- Compatible with R3265A and R3271A Analyzers
- Direct On-screen Readout of Measurements
- High Optical Input Sensitivity
- Wide Frequency Range to 2.4 GHz
- Excellent Frequency Response Flatness
- High Input Return Loss

Applications

- Characterization of Cable TV Optical Assemblies:
  - Laser Diode Transmitters
  - Erbium Doped Fiber Amplifiers (EDFA)
- Direct Measurement of Cable TV Analog Parameters:
  - Relative Intensity Noise (RIN)
  - Carrier-to-Noise Ratio (C/N)
  - Percent Modulation

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ADVANTEST Q32605

This plug-in combined with an Advantest RF Spectrum Analyzer is used to measure and display certain specific noise and modulation characteristics of optical sources and optical fiber amplifiers. These sources are operating in the 1200 nm to 1600 nm optical wavelength range and operating in continuous wave or with analog modulation in the 6 MHz – 2.4 GHz band. Such sources are used in telecommunications and cable TV transmission.

The Q32605 allows an Advantest R3265A or R3271A RF Spectrum Analyzer to directly measure the percent of modulation, average optical power, carrier-to-noise (C/N) ratio, and relative intensity noise (RIN) of single mode optical sources such as distributed feedback (DFB) lasers. All of these measurements are used to characterize fiber optic sources used in analog cable TV transmission.

Additionally, average optical power and RIN measurements are important in the characterization of lasers and fiber amplifiers used in digital telecommunications. These type measurements are made in design engineering, manufacturing, standards compliance test, and service applications using the above optical sources.

GENERAL

The Q32605 is a palm-sized plug-in module fitting into a front-panel slot in the Advantest R3265A or R3271A RF Spectrum Analyzer. This plug-in is a special purpose optical-to-electrical (O/E) converter whose electrical outputs are both AC and DC coupled into the spectrum analyzer. No modification to the analyzer is necessary to use this plug-in. Use of this plug-in with earlier Advantest R3265/3271 Spectrum Analyzers may require factory modification of the analyzer. Contact Tektronix for further information.

KEY PRODUCT FEATURES AND BENEFITS

The Advantest R3265A or R3271A RF Spectrum Analyzers have special built-in firmware that allows the operator to directly and easily make the above measurements by utilizing simple menu selections provided on the instrument front-panel display. Unlike alternative measurement methods, no time-consuming external equipment connection, reconfiguration or off-line manual computations are required by the operator to acquire the measurement data and to display the results.

Characteristics

Optical input wavelength range – 1200 nm to 1600 nm.

Maximum input optical power – Average light: +10 dBm. Modulated light: –10 dBm.

Modulated optical power measurements – Frequency range: 6 MHz to 2.4 GHz. Flatness: ±1.8 dBm, optical.*1 Optical input sensitivity: –56 dBm, optical,*2 –160 dB/Hz.*3

Average optical power measurements – Accuracy: ±0.25 dB. Measurement range: –20 dBm to +10 dBm.

Measurement function – RIN measurement: Directly read on Spectrum Analyzer screen. % modulation measurement: Directly read on Spectrum Analyzer screen.

Input/output – Optical input: FC/PC type connector, single mode fiber.*4 RF output: SMA type electrical connector.

Input return loss – ≤ 40 dB.

Operating environment – 0 to 40°C, ≤ 85% relative humidity.

Storage environment – –20 to +60°C, ≤ 90 % relative humidity.

**1 130 MHz as the standard.*

**2 Noise level converted to light input. For the RF spectrum analyzer: RBW = 1 Hz, VBW = 30 Hz, Att = 0 dB.*

**3 Noise level converted to RIN. Average optical power: +8dBm.*

**4 When a low reflection PC optical connector is used.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Q32605
Advantest Optical Receiver Plug-in.
Includes: Instruction Manual.

Optical Spectrum Analyzers
Q8383 • Q8381A • Q8344A

Features

Q8383
- Double-pass Diffraction Type Measurements
- Wide Dynamic Range
- High Accuracy
- Low Polarization Dependence
- Excellent Linearity
- High Accuracy Wavelength Setting Resolution
- Optical Amplifier Noise Figure Measurement Function
- Accurate Pulse Measurements

Q8381A
- Single-pass Diffraction Type Measurements
- Wide Wavelength Range
- High Sensitivity
- Low Polarization Dependence
- Power Monitoring with Trend Display
- Versatile Memory Functions

Q8344A
- Michelson Interferometer Type Measurements
- Direct Coherence Length Measurements
- Fast Scanning

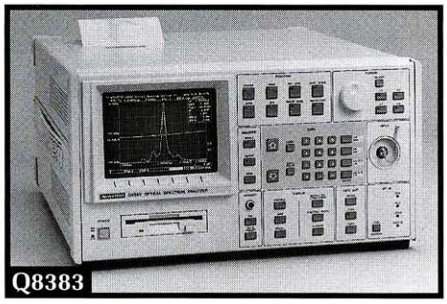
Applications
- Optical Fiber Amplifier Measurements
- Communications Laser and LED Transmitter Characterization
- Manufacturing Test of Optical Sources
- Optical Source Standards Compliance

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.


Q8383

Advantest Q8383

The Q8383 is an outstanding general purpose optical spectrum analyzer for use in the spectrum analysis of laser diodes (LDs), for measuring the wavelength characteristics of other optical components, and characterizing erbium doped fiber amplifiers (EDFA). The wide dynamic range of 65 dB has been achieved with a design employing a Czerny-Turner type double-pass monochromator which uses Advantest's unique optical technology. These innovations facilitate side mode suppression ratio (SMSR) measurements on DFB laser diodes and light level measurements of amplified spontaneous emissions (ASE) on fiber amplifiers.

For measurement of pulse modulated light, the Q8383 provides a pulse light mode and synchronous input terminal. This pulse mode measures the peak level within a specified gate time, while the synchronous input terminal measures the light pulse by controlling measurement timing from an external input signal. This spectrum analyzer is ideal for measurements when circulating loop tests are performed in long haul transmission experiments.

During optical tests on optical amplifier characteristics, gain and noise figure (NF) measurement accuracy are greatly affected by the characteristic performance of the spectrum analyzer. Critical characteristics include the dynamic range, polarization dependence, level accuracy, linearity, and wavelength resolution setting accuracy. The Q8383 provides a curve-fitting function ensuring that EDFA ASE level, gain, and NF measurements can be made easily with high accuracy using the optical amplifier NF measurement function.

The Q8383's unique measurement method offers an extremely low polarization dependence which is within ±0.05 dB at any wavelength. In addition the wavelength sensitivity compensation is performed for each and every unit. This results in a very low polarization dependency.

Advantest Q8381A

The Q8381A is a general purpose optical spectrum analyzer utilizing a single-pass monochromator design. Like the Q8383, it provides a high sensitivity measurement at a fast sweep speed. The Q8381A also provides a pulse measurement mode and an optical power measurement with trend display capability. The Q8381A provides a lower dynamic range but a wider optical wavelength range and lower price than the Q8383. Like the Q8383, the Q8381A has a battery backed-up internal memory and an MS-DOS compatible floppy disk drive for measurement and set-up data storage and retrieval. Although low by competitive standards, the polarization dependence of the Q8381A is not as low as that of the Q8383.

Advantest Q8344A

The Q8344A makes use of a Fourier spectrum analysis approach based on a Michelson interferometer. Because of this, the Q8344A can measure optical coherence that cannot be obtained directly using diffraction-type optical spectrum analyzers which use monochromators to make their measurements.

The features of this analyzer make it very effective for the evaluation of laser diodes used in optical data storage equipment, fiber optic gyroscopes, and related applications. The Q8344A has a built-in He-Ne laser that functions as the wavelength reference and ensures the wavelength measurement accuracy is maintained within ±0.1 nm (at 1.3 μm). Because of this internal reference source, no calibration is needed, thereby allowing this analyzer to provide long-term repeatable measurements.

This instrument is exceptionally well suited to the measurement of coherence length of LD and LED optical sources operated in continuous wave mode. Unlike the Q8383 and Q8381A, the Q8344A is not suitable for spectral analysis of modulated light sources.

Optical Spectrum Analyzers

Q8383 • Q8381A • Q8344A

CHARACTERISTICS

	Characteristic	Q8383	Q8381A	Q8344A
Wavelength	Measurement range	550 nm to 1750 nm	350 nm to 1750 nm	350 nm to 1750 nm
	Resolution settings	0.1, 0.2, 0.5, 1.0, 2.0, 5.0 nm	0.1, 0.2, 0.5, 1.0, 2.0, 5.0 nm	0.05 to 0.1 nm max resol. (at 0.85 & 1.31 µm)
	Accuracy	±0.5 nm	±0.5 nm	±0.1 nm
	Repetitive reproducibility	≤ 0.1 nm	≤ 0.1 nm	
Level	Measurement range (input sensitivity)	–85 to +10 dBm (1.2 to 1.65 µm) –55 to +10 dBm (0.55 to 1.75 µm)	–85 to +10 dBm (1.1-1.6 µm) –75 to +10 dBm (0.7-1.6 µm) –70 to +10 dBm (0.4-1.65 µm) –60 to +10 dBm (0.35-1.75 µm)	–70 to +10 dBm (0.7-1.6 µm) –60 to +10 dBm (0.45-1.7 µm) –45 to +10 dBm (0.35-1.75 µm)
	Polarization dependence	within ±0.05 dB	≤ 0.1 dB pk-pk	–
	Accuracy	within ±0.4 dB	≤ ±1.5 dB, (at 0.633, 1.31, & 1.55 µm)	≤ ±2.0 dB, (at 0.85 or 1.31 µm)
	Linearity	±0.05 dB (1.2 to 1.65 µm, –50 to +10 dBm)	±0.5 dB at ≤20 dB, ±1.0 dB at ≤40 dB	±0.5 dB at ≤10 dB, ±1.0 dB at ≤25 dB
	Scale	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div and linear	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div and linear	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div and linear
	Dynamic range	≥ 55 dB (±0.5 nm from peak) ≥ 65 dB (±1.0 nm from peak)	≥ 40 dB (±1.0 nm from peak) ≥ 50 dB (±5 nm from peak)	–
Sweep	Measurement time	≤ 0.8 sec (≤ 200 nm span)	≤ 0.8 sec (≤ 200 nm span) ≤ 1.5 sec (≤ 500 nm span)	≤ 1.5 sec (SNGL mode, 1 avg.)
Pulse light measurement	Peak hold mode	≥ 10 ns pulse width, (≥ 30 µs recommended) ≥ 0.1 Hz pulse rep. rate Gate time: 1 ms to 10 sec	≥ 30 µs pulse width Gate time: 1 ms to 10 sec	N/A
	Synchronous (gated) measurement input	Sync. sig. input level: 3.5 V high, 1.5 V low, pos. logic Min optical pulse width: ≥10 ns (30 µs recommended) Optical pulse rep. rate: DC to 100 MHz	Sync. sig. input level: 3.5 V high, 1.5 V low, pos. logic Min optical pulse width: ≥10 ns (30 µs recommended)	N/A
Processing functions	Data storage	Battery backed-up RAM, MS-DOS format floppy disk	Battery backed-up RAM, MS-DOS format floppy disk	Battery backed-up RAM
	Calculation, analysis, & display	Optical amp NF function, Power monitor & trend, Measurement cursors, Dual screen & superimpose display, Split display, 3-D display function, Averaging	Auto optimum settings, Auto peak search, Measurement cursors, Power monitor & trend, Luminosity compensation, 3-D display function, Superimpose & split displays, Averaging	Coherence analysis, Auto optimum settings, Auto peak search, Measurement cursors, 3-D display function, Averaging
Input/Output	Optical input	FC type connector	FC type connector	FC type connector
	Data output	GPIB IEEE 488 control Internal printer Direct plotter output	GPIB IEEE 488 control Internal printer Direct plotter output	GPIB IEEE 488 control Internal printer option Direct plotter output
General	Operating environment	+10 to +40° C, ≤ 85% RH (noncondensing)	+10 to +40° C, ≤ 85% RH (noncondensing)	+10 to +40° C, ≤ 85% RH (noncondensing)
	Power supply	90 to 250 V AC, 48 to 66 Hz, ≤ 180 VA	90 to 250 V AC, 48 to 66 Hz, ≤ 180 VA	90 to 132 V AC , (198 to 250 V AC optional), 48 to 66 Hz, ≤ 180 VA
	Dimensions	424 (W) x 221 (H) x 450 (D) mm	424 (W) x 221 (H) x 450 (D) mm	424 (W) x 221 (H) x 500 (D) mm
	Weight	≤ 28 kg	≤ 29 kg	≤ 27 kg

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Q8383 – Advantest Optical Spectrum Analyzer.
Includes: Instruction Manual, Power Cable (A01402), Printer Paper (100-0688-00).

Q8381A – Advantest Optical Spectrum Analyzer.
Includes: Instruction Manual, Power Cable (A01402), Printer Paper (100-0688-00), and 3.5 in. Floppy Disk.

Q8344A – Advantest Optical Spectrum Analyzer.
Includes: Instruction Manual, Power Cable (A01402).

Opt. 01 – Built-in Printer (with paper).

Opt. 10 – 200 µm Fiber Input.

Opt. 40 – 198 to 250 V AC Power.

Thermal printer paper – Order 100-0688-00 for built-in printer (5 roll box).

MEASUREMENT SERVICE OPTIONS

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Handheld Optical Power Meter

TQ8210

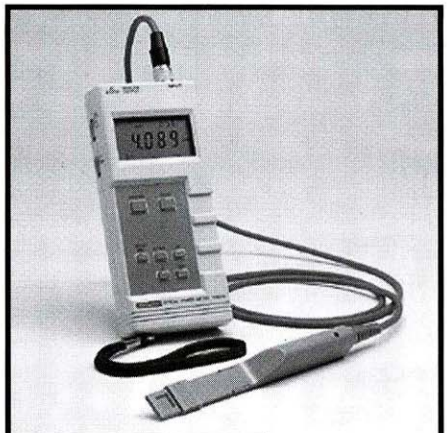
Features

TQ8210

- Automatic Wavelength Sensitivity Compensation
- Multiple Sensors Available
- Battery and AC Line Powered
- High Sensitivity
- Wide Dynamic Range
- Measurement Smoothing
- Max-hold Function
- Backlit Liquid Crystal Display
- Analog Output
- Easy to Use

Applications

- General Optical Power Measurements
- Fiber Optic Manufacturing Test
- Optical Communications Equipment R&D
- Optical Data Storage Testing
- Optical Equipment Calibration and Repair



TQ8210 with TQ82017

The Advantest TQ8210 is a general purpose battery or AC powered portable optical power meter. It is a compact and easy to use handheld unit weighing less than 400 g. The TQ8210 can be operated continuously on its internal battery supply for up to 13 hours before recharge. Optical power measurements can be made over –60 dBm to +17 dBm levels and in the 400 nm to 1650 nm wavelength range using one of the available power sensors specified below.

KEY FEATURES

Depending upon the measurement requirements and the physical configuration needed, one of several power sensor units can be selected to work with the TQ8210 mainframe. Optical power sensors using silicon photo diodes are available for use at shorter wavelengths. At longer wavelengths, sensors based on germanium (Ge) or indium-gallium-arsenide (InGaAs) are available and recommended. The TQ8210 automatically applies a wavelength sensitivity compensation factor to the optical power measurement for any of the available power sensors attached.

To allow maximum flexibility in making measurements in tight spaces or awkward positions, the power sensors are connected to the mainframe using a flexible electrical cable which is detachable from the handheld unit. The mechanical design of some power sensors also allow them to be used with both free-space optical beams as well as bare or connectorized optical fibers. A wide range of fiber connector types are accommodated by selecting the appropriate connector adapter for the sensor being used.

The TQ8210 has several built-in functions that contribute to its measurement capability and ease of use. Automatic measurement range selection and max-value hold is available with a button push. Also, measurement smoothing using a variable length moving average can be invoked using one button.

Power measurements can be conveniently displayed on a linear power scale (milliwatts, microwatts, nanowatts) or on a logarithmic absolute (dBm) or relative (dBr) scale. Sensor measurement offset is automatically detected and compensated.

Mainframe Characteristics

BASIC CAPABILITIES

Wavelength & Power Ranges – Depends upon sensor selected.

Sensor Plug-in Channels – One.

Resolution – 0.005% to 0.1% (Watt readout), 0.01dB (dBm readout).

Display – Backlit liquid crystal, 4 digits (wavelength), 4-1/2 digits (power).

TQ8210 OPTICAL POWER SENSOR SPECIFICATIONS:

Characteristic	TQ82014/TQ82017	TQ82015	Q82018A
Wavelength range	400 to 1100 nm	800 to 1600 nm	800 to 1650 nm
Power range*1	–60 to +17 dBm (1 nW to 50 mW)	–40 to +10 dBm (100 nW to 10 mW)	–60 to 0 dBm (1 nW to 1 mW)
Photo sensor type	Silicon photo diode	Germanium photo diode	InGaAs PIN photo diode
Optical input form*2	Beam or fiber	Beam or fiber	Fiber only
Size of photo sensor's active area	TQ82014: 8 mm dia.*3 TQ82017: 10 mm x 10 mm*4	5 mm dia.	–
Measurement ranges	8 ranges in 10 dB steps	5 ranges in 10 dB steps	6 ranges in 10 dB steps
Measurement accuracy	±5.0% (at 850 nm)	±5.0% (at 1300 nm)	±5.0% (at 1300 nm)
Connection to TQ8210 Mainframe	sensor attached cable	sensor attached cable	A01905 sensor cable

**1 At reference wavelength shown under Measurement Accuracy.*

**2 Refer to connector-to-adapter correspondence table on next page for required adapters.*

**3 The TQ82014 has a 38 mm (dia.) x 40 mm (length) cylindrical sensor housing with attached cord.*

**4 The TQ82017 has a wand-shaped sensor housing (3.2 mm thick x 18 mm wide tip) with attached cord.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Handheld Optical Power Meter
TQ8210

(Mainframe Characteristics continued)

Sensor Wavelength Compensation – Automatic for sensor sensitivity at set wavelengths.

Units Display – Watts (mW, µW, nW), dBm, dBr, Wavelength (nm).

Range Switching – Automatic or manual.

Measurement Rate – ≥ 2 measurements/sec.

PROCESSING

Averaging – Digital smoothing by 2 to 20 sample moving average.

Measurement Functions – Maximum value hold (Watt meas.), Relative value measurement (dBr).

Offset & Zero – Automatic sensor offset zero compensation.

INPUT/OUTPUT

Optical Input – Input style & connector type determined by sensor & adapter, sensor attached with electrical cable to mainframe.

Data Output – Analog output voltage (0 to 2 V) proportional to input optical power, output impedance ≤ 10Ω.

GENERAL

Operating Environment – 0 to +40°C, ≤ 85% RH (non condensing).

Power Supply – Internal NiCd battery (operating life >10 hrs. with LCD backlight on, >13 hrs. with backlight off), 100 V AC (using AC adapter, which also charges the NiCd battery).

PHYSICAL CHARACTERISTICS

Dimensions (approximate)	mm
Width	80
Length	180
Height	35
Weight	**g**
Net	≤400

SELECTION GUIDE

Optional Accessory	Used With Q8221	Used With TQ8210	Description
A01905		√	Sensor cable
A08012	√	√	Connector adapter, FC
A08013	√	√	Connector adapter, D4
A08014		√	Connector adapter, OF2
A08017		√	AC Power adapter (90 to 110 V AC)
A08019		√	AC Power adapter (200 to 245 V AC)
A08020	√	√	Bare fiber adapter, V groove (requires A08021)
A08021	√	√	Adapter cap (required by A08020)
A08024		√	Bare fiber adapter, FC type
A08025		√	Connector adapter, AT&T Biconical
A08026		√	Connector adapter, Diamond 2.5
A08027		√	Connector adapter, Diamond 3.5
A08028	√	√	Connector adapter, Amphenol SMA
A08029		√	Connector adapter, Siemens
A08030		√	Connector adapter, Sumitomo Mini-BNC
A08031		√	Connector adapter, MBO
A08032		√	Connector adapter, HFBR-4000
A08081		√	Connector adapter, FC/PC (required by Q82018A)
A08082		√	Connector adapter, SC (required by Q82018A)
A08083		√	Connector adapter, ST (required by Q82018A)
A08084		√	Connector adapter, DIN (required by Q82018A)
A08090	√	√	Connector adapter, SC
A08095		√	Connector adapter, SMA 2.5
A08096	√	√	Connector adapter, ST
A08161	√		Connector adapter, FC (used with Q82208)
A08162	√		Connector adapter, SC (used with Q82208)
A08163	√		Connector adapter, ST (used with Q82208)
A08186	√		Connector adapter, low return loss
A08187	√		Connector adapter, FC (used with Q82215 and Q82216)

CONNECTOR-TO-ADAPTER CORRESPONDENCE

Connector Type	TQ82014	TQ82015	Q82018A
FC/PC	A08012	A08012	A08081 (Standard accessory)
SC	A08090	A08090	A08082
ST	A08096	A08096	A08083
Biconical	A08025	A08025	–
D4	A08013	A08013	–
DIN	A08029	A08029	A08084
SMA 2.5	A08095	A08095	–
SMA 3.175	A08028	A08028	–

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative,inside the U.S. see the price list in the back of this catalog.

TQ8210
Handheld Optical Power Meter Mainframe.
Includes: Instruction Manual, AC Power Adapter.

TQ82014
Power Sensor, 0.4 µm to 1.1 µm.

TQ82015
Power Sensor, 0.8 µm to 1.6 µm (Ge).

TQ82017
Power Sensor, 0.4 µm to 1.1 µm, Thin Wand.

Q82018A
Power Sensor, 0.8 µm to 1.65 µm (InGaAs).

MEASUREMENT SERVICE OPTIONS

TQ82015/17/18A

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

High Resolution Optical Spectrum Analyzer
Q8347

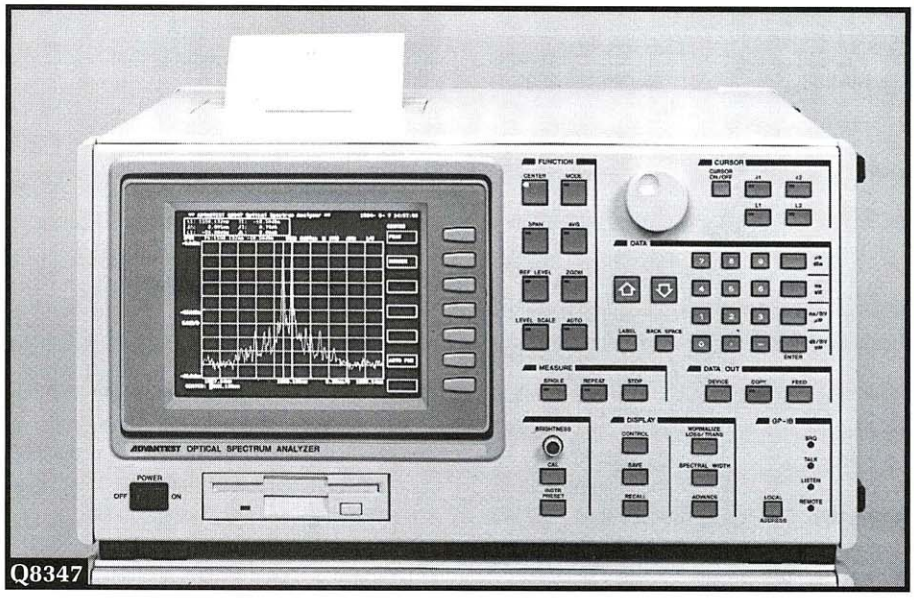
Features

Q8347

- Michelson Interferometer Type Measurements
- High Wavelength Resolution
  – 0.01 nm at 1.55 µm
  – 0.001 nm at 0.5 µm
- Enhanced Wavelength Accuracy
- Direct Coherence Length Analysis
- Wide Wavelength Range
- High Accuracy Wavelength Setting Resolution
- Color LCD Display
- Friendly User Interface

Applications

- WDM Transmission Analysis
- Analysis of Source Coherence Length
- Characterization of Narrow-band Optical Filters
- Communications Laser and LED Transmitter Characterization
- Manufacturing Test of Optical Sources and Components
- Optical Transmission Standards Compliance
- Short Wavelength Laser Characterization



Q8347

Advantest Q8347

The Q8347 makes use of a Fourier spectrum analysis approach based on a Michelson interferometer. Because of this the Q8347 can measure optical coherence that cannot be obtained directly using diffraction type optical spectrum analyzers which use monochromators to make their measurements. The Q8347 provides a high wavelength resolution measurement capability in the 350 nm to 1750 nm wavelength band. This instrument achieves a wavelength resolution that is ten times that of conventional optical spectrum analyzers.

With its high wavelength resolution and enhanced accuracy, the Q8347 is an advanced and powerful optical spectrum analysis tool providing the unique measurement capabilities needed in the design, development, and manufacture of wavelength division multiplexed (WDM) communication equipment, as well as related assemblies and components utilizing very closely spaced optical carriers.

The Q8347 also provides unique measurement capabilities when characterizing narrow band passive optical filters and wavelength selective couplers. Also, because of its short wavelength capabilities, the Q8347 is useful in the optical coherence length analysis required for research on shorter wavelength laser diodes.

These features make this analyzer very effective for the evaluation of laser diodes used in optical data storage equipment, fiber optic gyroscopes, and related applications, as well as high speed communications equipment. This instrument is exceptionally well suited to the measurement of coherence length of laser diode and LED optical sources.

A standard rackmount set is available for both the Display Unit and Optical Unit making up the Q8347.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

ADVANTEST *Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.*

High Resolution Optical Spectrum Analyzer
Q8347

SPECIFICATIONS

	Characteristic	Q8347
Wavelength	Measurement range	350 nm to 1750 nm
	Maximum resolution*1	Approx. 0.01 nm at 1.55 µm; approx. 0.003 nm at 0.85 nm
	Accuracy	±0.01 nm or less
Level	Measurement range (input sensitivity)*2	–65 to +10 dBm (0.7 to 1.6 µm) –52 to +10 dBm (0.45 to 1.7 µm); –42 to +10 dBm (0.35 to 1.75 µm)
	Accuracy	≤ ±2.0 dB (at 0.85 µm, 1.31 µm, and 1.55 µm)
	Linearity	≤ ±1.0 dB/25 dB; ≤ ±0.5 dB/10 dB
	Dynamic Range	≥30 dB (±0.5 nm from peak wavelength)
	Polarization Dependence	≤ ±0.1 dB (+23 ± 5°C)
Processing functions	Measurement time	≤ 2.5 sec (high res. mode, 0.95 µm to 1.75 µm wavelength band)*3, ≤ 1 sec (normal mode)*3
	Memory function	16 screens of measured data and 10 screens of measurement conditions (with battery backup), 3.5 in. floppy disk (720 KB/1.2 MB, MS-DOS format)
	Display	Dual trace, super-impose, "3-D" display, trend monitor
	Monitor functions	Average optical power and wavelength monitoring and display
	Computing/Analysis	Spectral width calculation, coherence length analysis (±165 mm), normalize function, auto peak search
Input/output	Optical input	FC type connector (50/125 internal fiber)
	Data output	GPIB IEEE 488 control interface. Built-in printer (≤8 sec print time) Direct plotter output*4
General	Operating environment	+10 to +40°C, ≤ 85% relative humidity (non-condensing)
	Power supply	100 to 120/240 V AC, 48 to 66 Hz
	Dimensions	Approx. 424 (W) x 221 (H) x 500 (D) mm (main unit); approx. 424 (W) x 132 (H) x 500 (D) mm (optical unit)

**1 Performance in high resolution mode.*

**2 The minimum level is measured over a 50 nm span with 16 averages.*

**3 On SINGLE measurement, one average is performed. Measuring time is from triggering to completion of display.*

**4 Compatible plotters: Advantest R9833, HP 7475A, HP7440A, and HP7470A.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Q8347
Advantest High Resolution Optical Spectrum Analyzer.
Includes: Instruction Manual, Power Cable (A01402), Fuse (2 ea.); Interconnection Cable; Printer Paper (100-0688-00); 3.5 in. Floppy Disk.

A09075
Thermal Printer Paper for Built-in Advantest Printer (5-roll Box).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

ADVANTEST *Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.*

Optical Power Multimeter
Q8221

Features

- Two Independent Plug-in Channels
- Optical Sensor and Source Plug-ins
- Simultaneous Channel Measurements
- Dual Channel Displays
- High Power Input
- High Sensitivity and High Accuracy
- High Speed Measurements
- Low Polarization Dependence
- On-board Recorded Data Memory
- GPIB Controllable

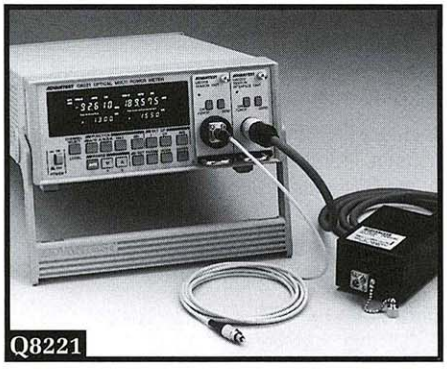
Applications

- General Optical Power Measurements
- Fiber Optic Manufacturing Test
- Optical Communications Equipment R&D
- Insertion Loss Measurements
- Optical Equipment Calibration and Repair

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

ADVANTEST *Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.*



Application Description

This bench-top instrument and its related family of plug-ins are intended for use by engineers and skilled technicians in the design, evaluation, manufacture, or service of fiber optic equipment and systems. This class of product is one of the most widely applicable fiber optic test and measurement instruments used in engineering, manufacturing, and service organizations. Typical applications include such things as:

- General purpose measurement of optical power in fibers and free-space beams
- Loss measurements in optical fiber and related components
- Characterization of laser and LED source output power and stability
- Fiber amplifier testing and characterization
- Calibration and repair of other optical instruments including power meters

Product Description – General

The Q8221 is a compact lab instrument providing both precision optical power measurement and stable light source capabilities. It is a small bench-top unit weighing less than 3.9 kg (with plug-ins). The Q8221 mainframe accepts two small plug-ins that can be either power sensors (detectors) or optical sources. Five types of optical sensors and nine types of light sources are available.

KEY PRODUCT FEATURES AND BENEFITS

The Q8221 mainframe allows measurement of optical power on two channels simultaneously. These measurements can be ratioed, multiplied by a constant, or offset, thus allowing a wide variety of applications. The mainframe's on-board processor also provides automatic wavelength compensation for the power sensor being used. This processor also allows measurement averaging, identification of maximum values, storage of up to 400 data points and five front-panel set-ups for each of the two channels. Also the mainframe provides direct output of digital stored data to an external plotter, real-time analog voltage output proportional to measured optical power, and full instrument operation via a GPIB controller.

Both single and multimode LED and laser sources are available and can be used in either or both plug-in slots. These stable sources operate at 850 nm, 1310 nm, and 1550 nm wavelengths. Source output power levels cover a wide range from 0 dBm to –53 dBm depending upon the source's wavelength, type (laser or LED), and spectral width. For further technical information refer to the Q8221 Product Data Sheet (Tektronix Literature # 2HA-10187-0).

Characteristics

BASIC CAPABILITIES

Wavelength and Power Ranges – Depends upon plug-in.

Sensor Plug-in Channels – Two independent measurement channels (A & B).

Resolution – 0.001 dB (dBm readout), 0.0001 dB (GPIB).

Display – Five and one half digits (7 segment FL device) with brightness adjustment, 11 segment measurement level bar-type meter.

Sensor Wavelength – If wavelength is entered, an internal wavelength compensation constant for the sensor is automatically applied.

Units Display – Watts (mW, µW, nW, pW), dBm, dB.

Range Switching – Automatic, manual, or remote.

Measurement Rate – Approx. 50 meas./sec (with integrate time of 7 msec), Approx. 9 meas./sec (with integrate time of 100 msec), 1 channel operation.

Optical Power Multimeter
Q8221

PROCESSING

Averaging – Can be set to any value from 2 to 256 (moving average).

Calculations – A/B, B/A, CF (in Watts mode; multiplication of measurement and constant value, in dBm mode offset can be added).

Other Measurement Functions – Maximum value hold, settable measurement integration time (100 msec, 20 msec, or 7 msec), relative value measurement (dBr, with 0.001 dB max. resolution), modes for CW or chopped light inputs.

Record Function – Memory storage of 400 data points for each of A and B channels (external data retrieval possible via GPIB interface).

Memory Function – Up to five instrument settings storable and readable for each of A and B channels.

INPUT/OUTPUT

Optical Input – Connector type determined by sensor head or plug-in.

Data Output – GPIB IEEE 488 control, 0 to 2 V analog output (each range) proportional to input optical power, direct output to external plotter.

GENERAL

Operating Environment – 0 to +40°C, ≤ 85% RH (noncondensing).

Power Supply – 100 to 230 V AC, 48 to 66 Hz.

Dimensions – 212 (W) x 88 (H) x 360 (D) mm, approximate.

Weight – Approximately 3.9 kg (including plug-in).

OPTICAL POWER SENSOR PLUG-IN SPECIFICATIONS

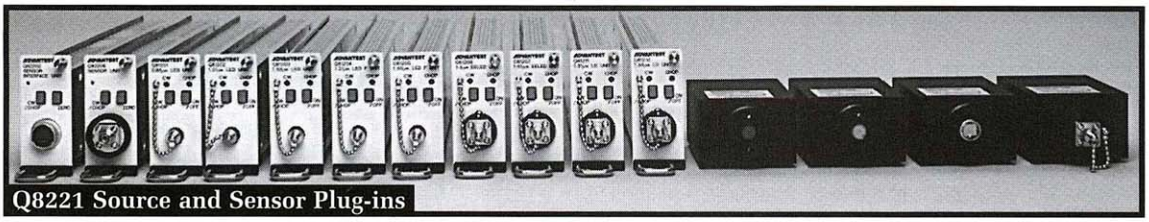
Characteristic	Q82214	Q82215	Q82216	Q82208	Q82227
Application type	Short wavelength, general purpose	Long wavelength, general purpose	Long wavelength, wide area, medium sensitivity	Long wavelength, high sensitivity	Long wavelength, high sensitivity, high power
Wavelength range (nm)	400 to 1100	800 to 1750	800 to 1750	800 to 1700	900 to 1650
Power range (dBm)	–80 to +17	–60 to +10	–77 to +10	–94 to +10	–80 to +27
Photosensor type	Silicon	Germanium	Germanium (cooled)	In GaAs (cooled)	In GaAs (cooled)
Optical input form*1	Beam or fiber	Beam or fiber	Beam or fiber	Fiber only	Fiber only
Measurement accuracy					
at calibration wavelength	±3.0%, 780 nm 1 mW, 0 to 40°C	±3.0%, 1300 nm 1 mW, 0 to 40°C	±2.5%, 1300 nm 1 mW, 0 to 40°C	±2.5%, 1300 nm 1 mW, 0 to 40°C	±2.5%, 1550 nm 1 mW, 0 to 40°C
Over wide wavelength range	±5.0%, 480 – 900 nm 1 mW, 23 ±3°C	±5.0%, 950 – 1600 nm 1 mW, 23 ±3°C	±4.5%, 950 – 1600 nm 1 mW, 0 to 40°C	±4.5%, 1000–1650 nm 1 mW, 0 to 40°C	±4.5%, 950–1600 nm 1 mW, 0 to 40°C
Linearity					
Over range 1	±0.5% ±10 pW, –54 to +17 dBm, 23 ±3°C	±0.5% ±1 nW, –37 to +10 dBm, 23 ±3°C	±0.5% ±20 pW, –47 to +10 dBm, 23 ±3°C	±0.5% ±0.4 pW, –72 to +10 dBm, 0 to 40°C	±0.5% ±10 pW, –58 to +27 dBm, 0 to 40°C
Over range 2	±1.0% ±10 pW, –57 to +17 dBm, 23 ±3°C	±1.0% ±1 nW, –40 to +10 dBm, 23 ±3°C	±1.0% ±20 pW, –50 to +10 dBm, 23 ±3°C	±1.0% ±0.4 pW, –75 to +10 dBm, 0 to 40°C	±1.0% ±10 pW, –61 to +27 dBm, 0 to 40°C
Noise level (one second average)	–80 dBm	–60 dBm	–77 dBm	–91 dBm	–80 dBm
Polarization dependence	–	0.03 dB p-p (typ)	0.03 dB p-p (typ)	≤0.02 dB p-p	≤0.05 dB p-p
Return loss	≥45 dB (with angled polished connectors), ≥30 dB (with A08186 adapter, depending upon specifications of fiber used), ≥14 dB (with flat polished connectors)				
Connection to Q8221 Mainframe	Q82202 interface plug-in required			Q82202 not required	Q82203 Interface Plug-in required
Dimensions and mass	Approx. 60 mm (W) x 43 mm (H) x 110 mm (L), ≤270 g			Plugs into Q8221	Approx. 60 mm (W) x 43 mm (H) x 135 mm (D), 500 g or less

**1 Refer to connector-to-adaptor correspondence table following.*

CONNECTOR-TO-ADAPTER CORRESPONDENCE

Connector Type	Q82214	Q82215	Q82216	Q82208
FC A08012	A08012	A08012	A08161*1	A08761*1
SC A08090	A08090	A08090	A08162	A08162
ST A08096	A08096	A08096	A08163	A08163
D4 A08013	A08013	A08013	–	
SMA	A08028	A08028	A08028	–
MT adaptor	– (mating to 12-Pin SMF)	A08187 (mating to 12-Pin SMF)	A08187	–

Optical Power Multimeter
Q8221


Q8221 Source and Sensor Plug-ins

OPTICAL SOURCE PLUG-IN SPECIFICATIONS

Characteristic*5	Q81201	Q81202	Q81203	Q81204	Q81205	Q81206	Q81207	Q81211*4	Q81212*4
Photo emitting element type	LED	LED	LED	LED	LED	Edge Emitting LED	Edge Emitting LED	Laser diode (FP)	Laser diode (FP)
Wavelength (nm)	850 ±25	1310 ±40	1550 ±30	1310 ±10	1550 ±10	1300 ±30	1550 ±30	1310 ±10	1550 ±20
Spectral width (at half max. power)	≤55 nm	≤160 nm	≤210 nm	20 ±5 nm	20 ±5 nm	≤100 nm	≤140 nm	≤5 nm	≤10 nm
Output power	–15 ±1 dBm*1	–20 ±1 dBm*1	–43 ±1 dBm*2	–35 ±1 dBm*1	≤–53 ±1dBm*2	–14 ±1 dBm*2	–17 ±1 dBm*2	0 ±1 dBm*2	0 ±1 dBm*2
Output power attenuation (variable)	–	–	–	–	–	–	–	0 to –6 dB (0.1 dB steps)	0 to –6 dB (0.1 dB steps)
Temperature Stability 23±2°C/1 hrs. 0 to 40°C/8 hrs.	≤ ±0.02 dB ≤ ±0.2 dB	≤ ±0.02 dB ≤ ±0.2 dB	≤ ±0.04 dB ≤ ±0.2 dB	≤ ±0.02 dB ≤ ±0.2 dB	≤ ±0.04 dB ≤ ±0.2 dB	≤ ±0.02 dB*3 ≤ ±0.4 dB	≤ ±0.04 dB*3 ≤ ±0.4 dB	≤ ±0.01 dB*3 ≤ ±1 dB	≤ ±0.01 dB*3 ≤ ±1 dB

*1 *At the emitting end of 2 m fiber (Graded index, 50/125 fiber type).*

*2 *At the emitting end of 2 m fiber (Single mode, 10/125 fiber type).*

*3 *Stability between 0 to 40°C ±2°C/1 hrs.*

*4 *Stability ≤ ±0.05 dB, within 0 to 40°C ±2°C/1 hrs.*

*5 *Output waveform: CW or chopped light (270 Hz, 2 kHz, 4 kHz), FC type output connector, Preheating time of 60 minutes after power on.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Q8221
Mainframe, Optical Power Multimeter.
Includes: AC Power Cable and Instruction Manual.

Q82202
Interface Plug-in.

Q82203
Interface Plug-in for Q82227.

Q82208
Power Sensor, High Sensitivity.

Q82214
Power Sensor, Short Wavelength, General Purpose.

Q82215
Power Sensor, Long Wavelength, General Purpose.

Q82216
Power Sensor, Large Area and Hi-sensitivity.

Q81201
LED Source, 850 nm.

Q81202
LED Source, 1310 nm.

Q81203
LED Source, 1550 nm.

Q81204
LED Source, 1310 nm.

Q81205
LED Source, 1550 nm.

Q81206
EELED Source, 1300 nm.

Q81207
EELED Source, 1550 nm.

Q81211
Laser Source, 1310 nm.

Q81212
Laser Source, 1550 nm.

MEASUREMENT SERVICE OPTIONS (EXCLUDING Q81206/207)

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

Depending upon the application and plug-in modules selected, one or more of the following fiber interconnection adapters may be needed:

A08012 – Connector Adapter, FC.

A08013 – Connector Adapter, D4.

A08020 – Bare Fiber Adapter (Requires A08021).

A08021 – Adapter Cap (Required by A08020).

A08028 – Connector Adapter, SMA.

A08090 – Connector Adapter, SC.

A08096 – Connector Adapter, ST.

A08161 – Connector Adapter, FC (Used with Q82208).

A08162 – Connector Adapter, SC (Used with Q82208).

A08163 – Connector Adapter, ST (Used with Q82208).

A08187 – Connector Adapter, FC (Used with Q82215 and Q82216).

RACKMOUNT KITS

A02463 – Rackmount Set (EIA, single).

A02464 – Rackmount Set (EIA, twin).

A02263 – Rackmount Set (JIS, single).

A02264 – Rackmount Set (JIS, twin).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

ADVANTEST

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Optical Wavelength Meter
TQ8325

Features

- Michelson Interferometer Design
- High Accuracy
- High Resolution
- High Speed
- Frequency & Deviation Displays
- Built-In He-Ne Laser Standard
- Input Level Meter
- Analog Output
- GPIB Controllable
- Calibration of Optical Spectrum Analyzers
- Communications Laser & LED Transmitter Characterization
- Calibration of Tunable Lasers
- Testing of Wavelength vrs Drive Current or Temperature
- Laser & LED Parts Screening

Applications

- Use as Wavelength Standard in the Calibration of Lab Monochromators
- Tune Dye Lasers and Monitor the Wavelength Output of Tunable Laser Sources
- Use in Automated Measurement of the Wavelength-temperature or Wavelength-drive Current Characteristics of Laser Diodes
- Measure Wavelength Fluctuation of Laser and LEDs While Devices Under Modulation
- Screen Laser Diodes and LEDs in the Manufacturing Environment

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

ADVANTEST *Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.*

Advantest TQ8325

The Advantest TQ8325 is a digital optical wavelength meter capable of making high accuracy, high resolution measurements of the central emitted wavelength of optical sources such as lasers and LEDs. Measurements are made based on an interference method using a single-pass Michelson interferometer working with an internal He-Ne laser wavelength standard.

This basic design allows a very high level of accuracy and resolution to be achieved and maintained over long periods of time without calibration. Wavelength measurement accuracies of 5 ppm and a resolution of 0.001 nm are achieved. Also the TQ8325 takes measurements at a rate of five per second thereby enabling the reliable measurement of changes in wavelength with changing temperature.

A switch selection enables measurements over the 0.6 to 1.0 µm or 1.0 to 1.6 µm wavelength bands. The TQ8325 can also measure the wavelength of modulated light sources for modulation rates of 3 MHz and above. An auto-resolution function automatically optimizes the resolution depending upon the spectral half-width of the source being measured.

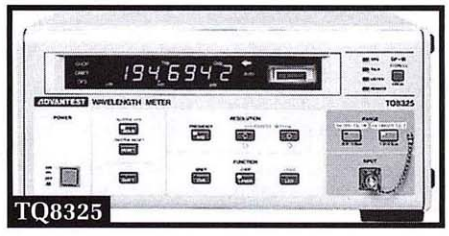
A simple switch operation determines whether measurements of wavelength or frequency are displayed. This feature is very useful when the frequency of a given light source must be read directly. The TQ8325 can also display the changing frequency deviation of a measured source from a reference frequency determined by pressing the deviation display key. This feature enables the continual wavelength changes (from temperature fluctuations) of a light source to be measured and displayed with high accuracy and resolution.

Characteristics

WAVELENGTH

Measurement Range – 600 nm to 1000 nm (short wavelength band). 1000 nm to 1600 nm (long wavelength band).

Display Resolution – 1 nm, 0.1 nm, 0.01 nm, 0.001 nm (10 digits). 100 GHz, 10 GHz, 100 MHz.



Accuracy – ±Full width (nm) at half maximum x 0.05 ± 5 ppm ± 1 count (at 25°C ± 10°C).

Stability – ± 1 count (in AVG mode)I.

LEVEL

Measurement Range (Input Sensitivity) – –23 to +3 dBm (0.6 to 1.6 µm). –15 to +3 dBm (0.48 to 0.6 µm).

SAMPLING

Sample Period – 200 ms (5 samples/sec rate).

NON CW INPUTS

CHOP Mode – Chopping frequency must be 1 to 500 Hz.

Modulated Input – Modulation must be ≥ 3 MHz.

PROCESSING

Averaging – Moving average of 10 measurements is displayed (AVG mode).

Deviation Display – Deviation is displayed in reference to the standard determined by pressing the deviation display key.

INPUT/OUTPUT

Optical Input – FC type connector.

Data Output – GPIB and Analog output.

GENERAL

Operating Environment – –10 to +40°C, ≤ 85% RH (non-condensing).

Power Supply – 90 to 132 V AC (standard), 180 to 250 V AC (optional). 50 to 60 Hz, ≤ 52 VA.

PHYSICAL CHARACTERISTICS

Dimensions	mm
Width	300 mm
Height	132 mm
Depth	450 mm
	kg
Weight	12 kg

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TQ8325
Advantest Optical Wavelength Meter.
Includes: Instruction Manual, Power Cable (AO1402).

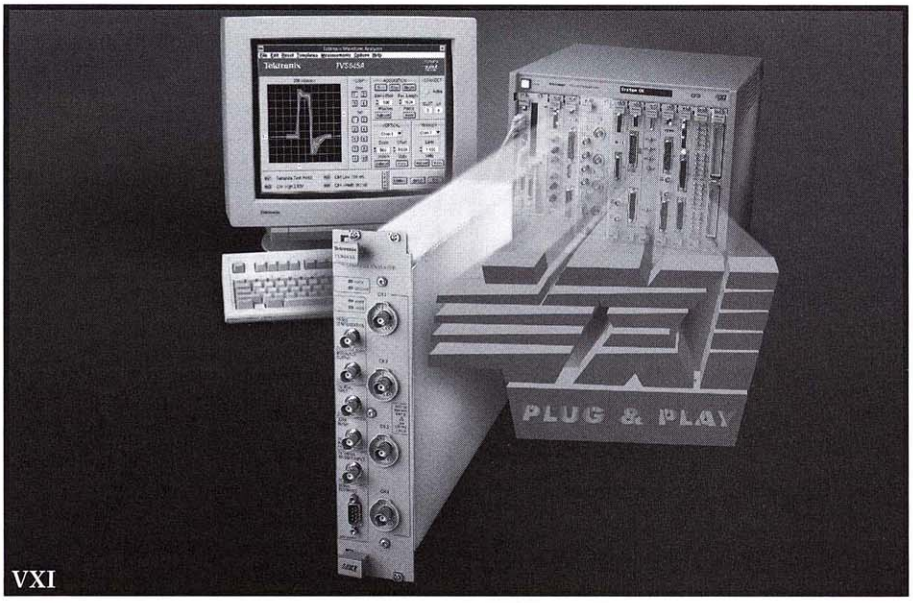
Opt. 4D – 180 to 250 V AC power.

MEASUREMENT SERVICE OPTIONS

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

VXI Introduction



VXI

CONTENTS

VXI

VXI Introduction....368
VXI Mainframes....370
VXI Digitizers/Waveform Analyzers....372
VXI TVS600A Waveform Analyzers....373
VXI Measurement....377
VXI Sources....378
VXI Digital....379
VXI Switching and Scanning....380
VXI Avionics....382
VXI Slot 0 Modules/Controllers....383
VXI Application Development Software 384
VXI Configuration Services....385
VXI Cables and Connectors....386
VXI Product Summary....388

Over the past few years, VXI ("VME eXtensions for Instrumentation") has emerged as the principal force for open systems in the test and measurement market. From strong beginnings in the military/aerospace arena, the VXI presence in commercial applications has expanded dramatically since 1991. VXI is of extreme importance to the marketplace. Its growing popularity is based on three key factors:

- Potential users need access to a comprehensive selection of products that meet their application requirements
- New VXI offerings must achieve the performance levels and price points customers demand
- Open systems with standardized software interfaces for compatibility are essential

As one of the founding members of the VXI standards movement, Tektronix has responded to these requirements by providing a broad portfolio of VXI instrument modules, setting price/performance benchmarks, and driving the test industry to create and support open system architectures.

Through seven years of tremendous growth, much of the attention on VXI has focused on building pieces and parts. Now, with over 1000 VXI products on the market, the focus is on how end-users can best integrate multi-vendor pieces into complete systems. This introduction to VXI*plug&play* describes how leading suppliers are working together to make VXI easier for you to use.

VXI: THE CHOICE FOR OPEN SYSTEMS

VXI is a multi-vendor industry standard (IEEE 1155) for modular instrumentation. Never before has VXI had as many capabilities as it does today. VXI products cover a wide range of applications, with components such as instruments, mainframes, software, controllers, and system solutions. The success of VXI as an open, multi-vendor platform is a testament to the value of multi-vendor standards, and has made VXI the platform of choice for open instrumentation systems.

STANDARD FRAMEWORKS

VXI*plug&play* uses the concept of standard system frameworks to achieve *"plug&play"* confidence. Each framework has a name, so it can be easily identified, along with a list of the operating system software and application development software tools used in the framework. Users choose their framework based on their system software, and then use the framework designation when choosing the rest of their system components.

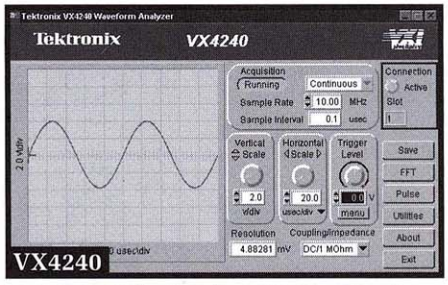
Popular VXI*plug&play* frameworks are based on Microsoft's Windows operating systems; WIN, WIN95 and WINNT. You can download Tektronix VXI*plug&play* instrument software from the Tektronix Web site (http://www.tek.com/Measurement/vxidrivers).

For more information on VXI*plug&play,* contact your local Tektronix representative.

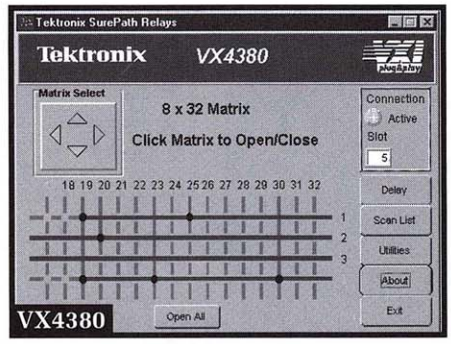
VXI Introduction

Features

- Interoperability
- Broad Range of Instrument Choices
- Open Architecture Supports Multi-vendor System Configurations
- VXI*plug&play* software
- VXI Configuration Services
- Worldwide Service and Support



12-Bit, 10 Ms/s Waveform Digitizer/Analyzer.



256 Cross Point Relay Matrix.

A Broad Product Portfolio

Today's Tektronix VXI product line includes a broad selection of VXI products capable of meeting widely varying customer needs and covers a major part of VXI market requirements. Many new Tektronix VXI products have completed the intense development process required for extremely high-performance products and are making important contributions to new markets. In its desire to provide complete VXI solutions to end-users, Tektronix has developed strategic partnerships with companies that provide complementary offerings such as LabWindows/CVI and LabVIEW software from National Instruments.

Customers include self-integrating end-users, third-party systems integrators, value-added resellers, and OEMs. VXI systems are now common in communications test equipment, computer and peripherals testing, avionics, automotive, ATE systems and medical manufacturing applications. Proven Tektronix VXI products include:

- Measurement Instruments: Waveform Digitizers/Analyzers, Digital Multimeters, and Universal Counter
- Stimulus Instruments: Pulse Generators, Arbitrary Waveform Generators, Digital Pattern Generators, D/A Converters and Function Generators
- Switching and Scanning Instruments and Accessories
- Digital Test Products
- Avionics Bus Testing Instruments
- Mainframes
- Slot 0 Interfaces and Embedded Controllers
- Application Development Software

Every year since Tektronix entered the VXI market, it has broadened and improved its VXI product portfolio.

PRICE/PERFORMANCE LEADERSHIP

As a leader in the VXI instrument modules market, Tektronix identified the need to set the pace for price/performance VXI solutions. In the past, test engineers, unable to find key VXI instruments capable of handling their application needs at a price within their budget, have been forced to create hybrid systems that incorporate both VXI and GPIB equipment. Older VXI designs are limited in performance and functionality because they are often benchtop instruments shoehorned into a modular format. Unable to take advantage of the benefits of the open VXI architecture, they can neither offer high enough performance nor fulfill the price/performance expectations that VXI promises. New Tektronix VXI products are developed exclusively for the VXI environment and designed to leverage every price and performance advantage in the architecture.

Examples of this are the new TVS600A Series of VXI waveform analyzers. The TVS600A is based on traditional Tektronix high-acquisition technology with VXI resources that make up this native high performance/higher throughput VXI waveform analyzer.

Test system developers who have been able to create only partial VXI solutions, or new adopters seeking to replicate their old GPIB systems with VXI, can now find the per -formance they need in a smaller package with the VXI form factor. One excellent example of this trend is the VX4101 which incorporates three core instrumentation functions – a 5.5 digit DMM, a high performance 250/500 MHz universal counter, and a SurePath™ switch controller – into a single slot module. Such dense functionality, industry-leading performance levels, and a highly competitive price, enable new Tektronix VXI products to make quantum leaps in performance, at excellent price/performance levels. That's the promise of VXI.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

VXI Introduction

Open Systems and an Open Market

As a founding member of the VXI Consortium, Tektronix established itself as a leader in defining today's VXI hardware compatibility standards. Though VXI is a well-established standard in the industry, software compatibility has been a limiting factor for overall industry acceptance of VXI. Due in large part to the efforts of Tektronix and other members of the VXI*plug&play* Systems Alliance, VXI today is a true open system with standardized software interfaces in place to make system integration easier. Tektronix is also a founding member of the VXI*plug&play* Systems Alliance and a driving force in support of VXI's open architecture advantage. As leaders in the test industry's move from GPIB to VXI, Tektronix and its strategic partners provide a full market spectrum of VXI*plug&play*-compatible products and software to end-users and systems integrators.

In 1996, important new standards were approved by members of the alliance, creating true interoperability at both the hardware and system software levels. VXI*plug&play* is a term used to indicate conformance to new system-level standards produced by the Alliance, including instrument drivers, soft front panels, I/O interface software, installation programs, documentation and fixturing support.

VXI*plug&play* instruments are now shipped with a standard diskette, including a driver matched to the user's operating system and application development environment. VXI*plug&play* software includes a standalone, executable soft front panel program that provides interactive control of the instrument. Because Tektronix actively participated in every committee involved in writing the new standards, the company is committed to the standard and can ensure that all new Tektronix products are fully VXI*plug&play*-compatible.

EXPERIENCED SYSTEM SPECIALISTS

For many test system development activities, "catalog shopping" is not the most efficient approach. Configuring the system, selecting components, and integrating the test system might be beyond the scope of many system users, and certainly outside the business charter of most. Often it is more economical to entrust these tasks to an experienced specialist – a system integrator.

Tektronix offers integration solutions to all of its customers, from the self-integrator who needs only minimal support to customers who rely on System Integrators to supply complete solutions. Tektronix, along with its Synergy partners, is positioned to provide you with the level of integration you need.

- Mainframe Configuration Services
- Tektronix/Synergy Partner Solutions

Since the job of most test engineers is to create test strategy and test programs, not to build test systems, a Tektronix test development solution can provide substantial economic savings. A typical system can require three months of development by several people. Tektronix offers several alternatives for system integration services.

Whatever your hardware or software Test and Measurement requirements, Tektronix can help you solve your test problem with a powerful open solution. And, as with all its products, Tektronix guarantees uniform quality, compatibility, and long-term support on a global scale.

SERVICE & SUPPORT

Tektronix, renowned for world class service and support for oscilloscopes, logic analyzers, and spectrum analyzers, brings this experience to our full line of VXI modules and systems. All Tektronix VXI instruments come with a full three year warranty (unless specifically stated otherwise in product specifications), and for customers with special needs, a full offering of tailored service plans is available.

SUMMARY

Tektronix, as a leader in the VXI market, is committed to supporting the depth of product line that is critical to VXI's long-term success. Its new product releases in 1997 further expand the company's VXI portfolio, adding products with breakthrough performance and extremely low cost per function. In addition, recognizing that no single manufacturer can fulfill every possible test requirement, Tektronix continues to pursue an open systems approach that protects customers from being locked into proprietary architectures. New levels of product availability, price and performance, combined with the ease of use created by open systems standards, are rapidly establishing VXI, and Tektronix VXI products, as the preferred solution for automated test applications that demand high throughput and performance in a small package.

MAINFRAMES

- 13-slot IntelliFrame® Mainframe
- 13-slot Low Cost Mainframe
- Portable 6-slot Mainframe

MEASUREMENT

- 4.5/5.5/6.5 Digit DMMs
- 10 MHz/250 MHz/3 GHz Counters
- A/D Comparators

DIGITIZERS

- 5 GS/s, 1 GHz High Performance
- 1 GS/s, 250 MHz High Performance
- 10 MS/s, 5 MHz High Throughput
- 200 KS/s, 300 kHz High Resolution

SOURCES

- 25 MS/s Arbitrary Generator
- 25 MHz Function Generator
- 16-Bit, 12-Channel D/A
- Dual Programmable Resistance

SWITCHING/SCANNING

- 120 Channel Scanners
- Matrix Switches
- Medium and High-density Switches
- High Current Switches
- 1.3 GHz RF Switches
- Relay/High Output Voltage Driver

DIGITAL

- Digital I/O
- Digital Functional Test
- Pulse Generator

AVIONICS

- ARINC 429 Bus Interface
- ARINC 629 with Error Injection Bus Interface
- Mil-Std-1553 Bus Interface

ATTENUATOR

- Optical Attenuator

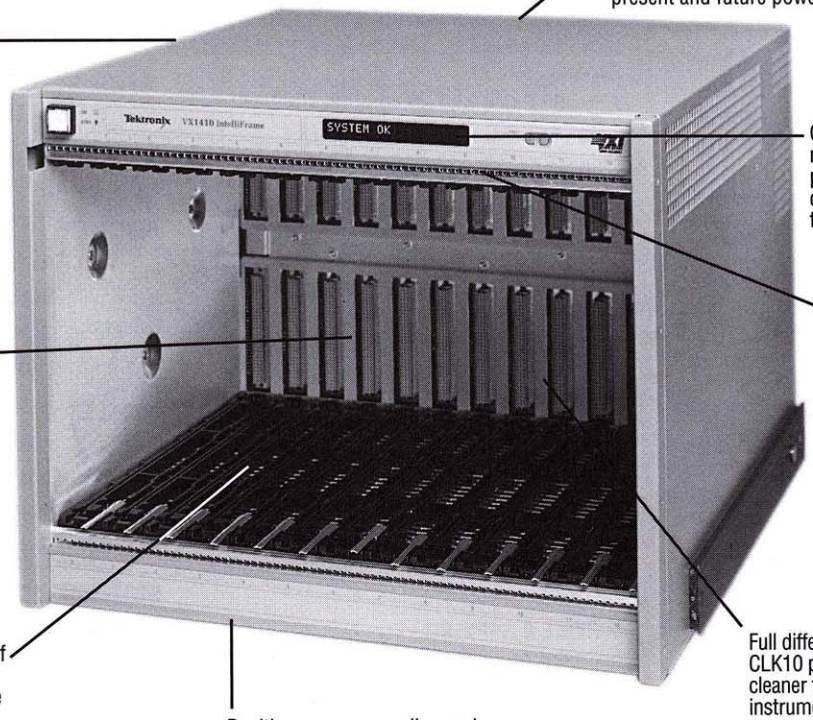
SLOT 0 INTERFACE/CONTROLLERS

- Embedded Pentium Controllers
- MXI Interface
- IEEE 488 (GPIB) Interface

VXI CONFIGURATION SERVICES

- Mainframe Configuration Services
- Tektronix/Synergy Partner Solutions

VXI Mainframes



UL listing, CSA certification, and EC 92 compliance guarantee a safe, quiet environment.

Power Supply with high peak and dynamic current capacity handles present and future power needs.

Optional enhanced monitor includes a front panel, fluorescent display used to sequence through mainframe status.

Intelligent Backplane automatically jumpers empty slots with highly reliable solid state implementation.

Input air temperature and the exhaust temperature for each slot are monitored to ensure proper cooling, and the fan speed is automatically adjusted.

IntelliGuides sense presence of modules and block airflow to empty slots. The result – more airflow where it's needed and quieter operation.

Full differential distribution of CLK10 provides a much cleaner timing source for VXI instruments.

Positive pressure cooling and metered plenum ensure uniform airflow across occupied slots.

VX1410 IntelliFrame Mainframe

VXI Mainframes

The mainframe can be viewed as the most important VXI instrument in a system. It is responsible for the complete environment for VXI modules: power, cooling, EMI, mechanical, and backplane communication and timing. The performance of the mainframe directly impacts the performance of the modules:

- More available power allows greater flexibility for future instrument selection
- Better mainframe cooling extends the life of the instruments
- More EMI protection improves measurement accuracy
- Better mechanical design makes maintenance and system integration easier
- Superior backplane CLK10 distribution improves system timing accuracy

Tektronix has a family of VXI mainframes to cover a broad range of applications. The VX1410 IntelliFrame® mainframe represents breakthroughs in each of the areas listed above. It can be configured as a benchtop or rackmounted system. The IntelliFrame mainframe also has superior fault isolation capability.

The VX1411 is an excellent, low cost, full size VXI mainframe that meets most application needs.

The VX1406 rounds out the Tektronix family of mainframes. It is a six slot VXI mainframe that is good for portable applications or engineering development.

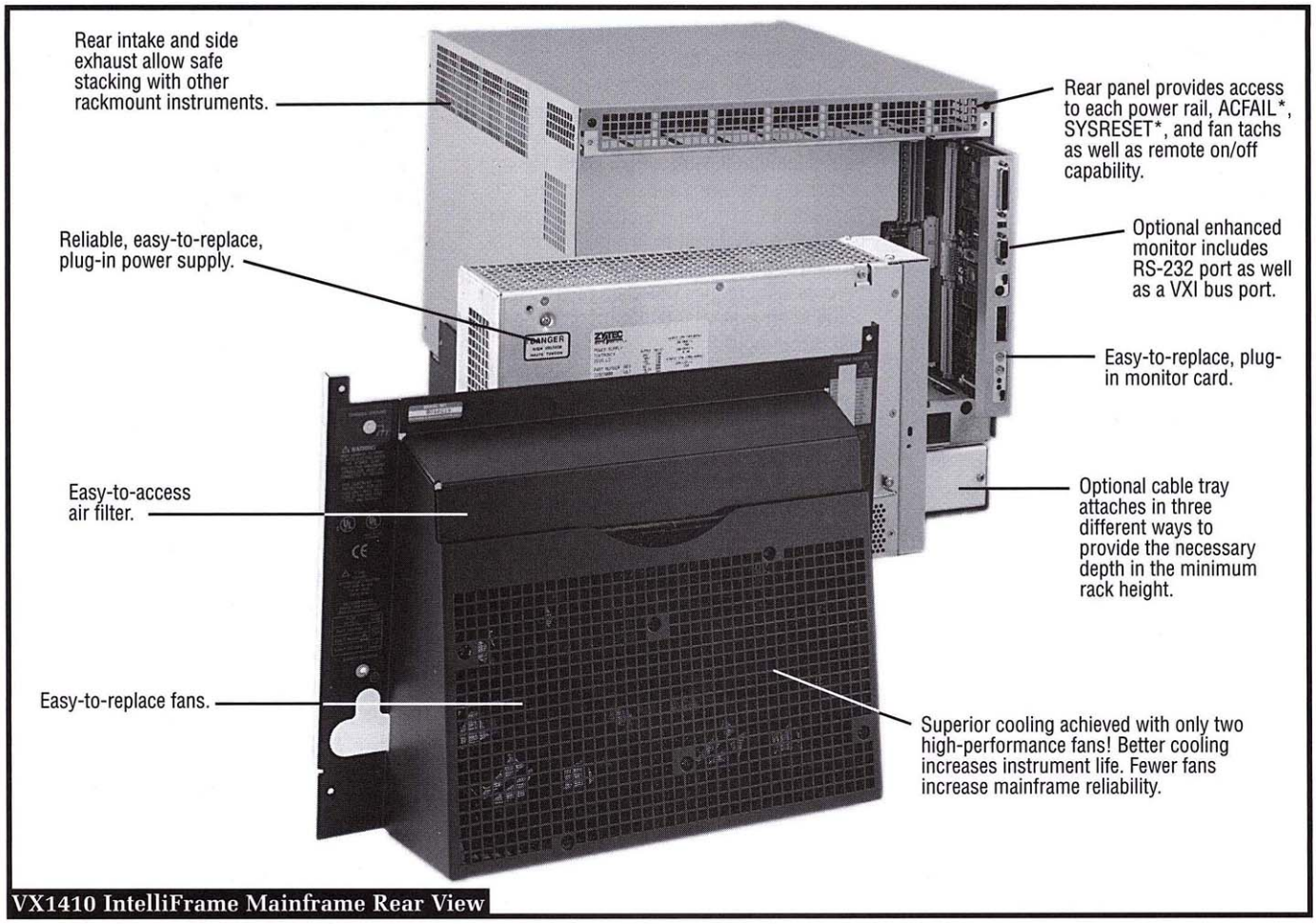
All Tektronix VXI mainframes have Options A1 through A5 for non-U.S. power cords.

- VX1410 Enhanced Monitor
  - Provides Readout of:
    Input temperature
    Exhaust temperature for each slot
    Each voltage rail
    Fan speeds
    Hours of operation timer
    Air filter cleaning timer
  - Allows user selection of alarm conditions
  - Communicates as a message-based instrument and RS-232
  - Includes VXI*plug&play* software driver
  - Includes bright front-panel fluorescent display

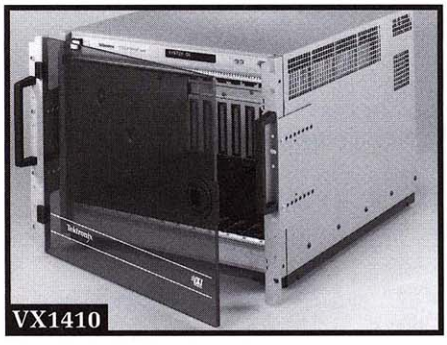
VX1410 OPTIONS NOT SHOWN ABOVE:

- Rack Kit
  - VXI*plug&play*-compatible, accepts VXI*plug&play* receivers without need for expensive adapters
  - Adjustable recess accommodates cables with large bend radii
  - Lexan door is stronger than acrylic, providing better protection while allowing visibility of instrument front panels
  - Top and bottom vertical cable accesses allow for shorter cables to instruments above and below the mainframe, improving signal fidelity

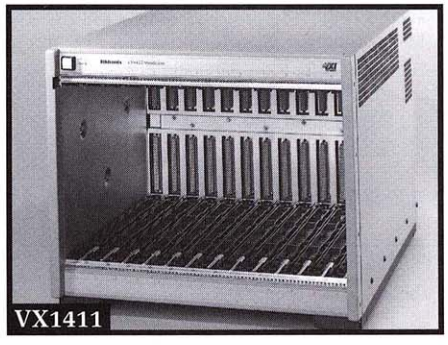
VXI Mainframes



VX1410 IntelliFrame Mainframe Rear View



VX1410



VX1411

VX1406

VX1410 INTELLIFRAME®
- 13 Slots
- Intelligent Cooling
- Easy Maintenance
- Powerful (Opt.) Enhanced Monitor
- Adjustable (Opt.) VXI*plug&play*-compatible Rack Kit

VX1411 LOW COST MAINFRAME
- 13 Slots
- Easy Maintenance
- Adjustable (Opt.) VXI*plug&play*-compatible Rack Kit

VX1406 PORTABLE MAINFRAME
- 6 Slots
- Removable Side Panel for Instrument Access
- Optional Rackmount Kit

VXI Digitizers/Waveform Analyzers

Features

DIGITIZERS

- 200 KS/s, 10 MS/s, 1 GS/s, 5 GS/s
- 16-Bit, 12-Bit, 8-Bit Resolution
- Extensive Signal Analysis
- Template & Limit Testing
- Flexible Signal Conditioning
- Sophisticated Triggers & Recording
- VXI*plug&play* in WIN, WIN95 and WINNT Frameworks

Applications

- High Performance ATE Systems
- Multi-channel Data Collection
- Research and Characterization

Digitizers/Waveform Analyzers

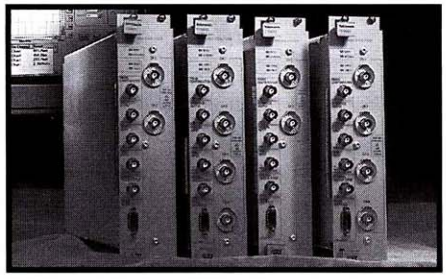
HIGH PERFORMANCE INSTRUMENTS

Tektronix offers a complete portfolio of digitizing products covering a broad spectrum of applications. These self-contained instruments include flexible signal conditioning to accurately capture a wide range of signals. Sophisticated trigger, timebase and memory features reliably capture events of interest. Built-in signal processing and analysis functions quickly reduce raw data to answers, simplifying system integration and enhancing test throughput.

All modules are fully compliant with VXI*plug&play* WIN, WIN95 and WINNT frameworks. Each instrument driver provides full access to product functions and the installation disk includes driver source code, pre-compiled DLL and a help file describing each function call. The soft front panel application provides a graphical interactive control panel that simplifies system integration and product familiarization. Each digitizer is message-based with enhancements for fast waveform transfer, simplifying integration into non-VXI*plug&play* environments.

SOPHISTICATED OSCILLOSCOPES IN VXI

TVS600A-series models offer two or four channels and 250 MHz or 1 GHz bandwidth. Packed with signal analysis functions that ensure accurate repeatable testing, these instruments provide the test system builder with a familiar and flexible test resource. Measurements and calculations can be combined in sophisticated expressions returning time- or frequency-domain traces, parametric values or simple pass-fail limit test indications. Waveform template testing with scaling, time-shifting and qualification criteria provides an additional standards-compliance test technique.



TVS600A Series of Waveform Analyzers.

MID-BANDWIDTH SYSTEM RESOURCE

The versatile VX4240 system digitizer offers high resolution, deep memory and built-in signal analysis making it an excellent solution for mid-bandwidth applications. The input range is finely programmable so signals can be spread over the full 12-Bit A/D range, maximizing resolution. Waveform memory is expandable from 256 Ksamples to 1 M for deep record applications. The instrument contains an extensive portfolio of application-oriented time- and frequency-domain measurements for efficient testing.

HIGH RESOLUTION MULTI-CHANNEL CAPTURE

The VX4244 offers 16 channels of simultaneous low speed, high resolution data capture. Channel groups may be independently triggered, clocked and transferred to the system controller. Trigger time-stamps preserve temporal relationships across groups and each group clock can be divided down from a master source. The companion VX4780 signal conditioning module expands the range of input signals and includes gain, attenuation and finely programmable low-pass filtering. Adding the VX4570 mass storage controller module and a SCSI disk drive creates a recording system capable of capturing extremely long time histories.

VXI OSCILLOSCOPES AND WAVEFORM DIGITIZERS

	Bandwidth	Channels	Sample Rate	Vertical Resolution	Record length
TVS645A	1 GHz	4	5 GS/s	8	15 K
TVS625A	1 GHz	2	5 GS/s	8	15 K
TVS641A	250 MHz	4	1 GS/s	8	15 K
TVS621A	250 MHz	2	1 GS/s	8	15 K
VX4240	5 MHz	1	10 MS/s	12	256 K to 1 M
VX4244	300 kHz	16	200 kS/s	16	64 K
		8	200 kS/s		128 K
		4	200 kS/s		256 K
VX4780	200 kHz	16	Signal Conditioner for VX4244		
VX4570	–	–	Mass Storage Controller for VX4244		

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

VXI plug&play

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

VXI Waveform Analyzers

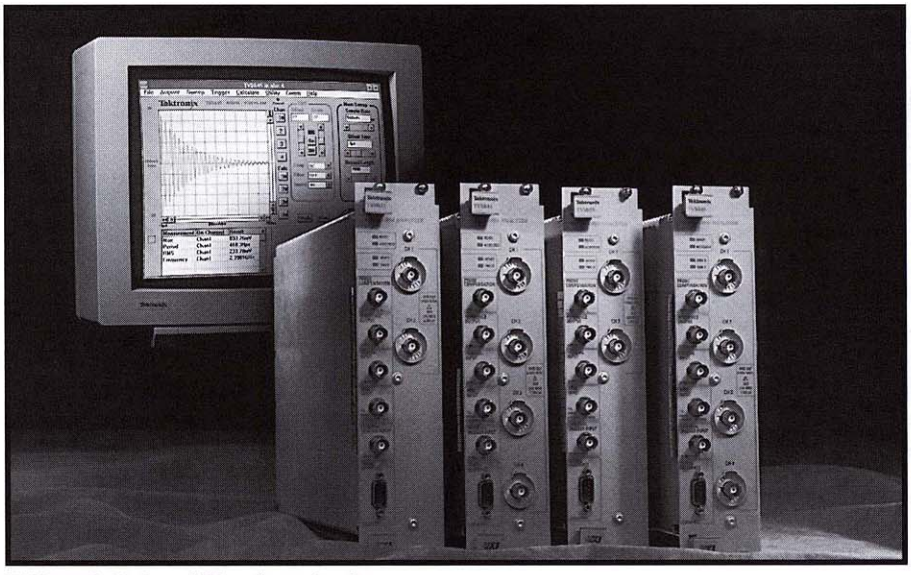
TVS621A • TVS625A • TVS641A • TVS645A

Features

- 1 GHz or 250MHz Bandwidth
- 5 GS/s or 1 GS/s Sample Rate
- 2 or 4 Channels
- 15 K Record Length
- Peak Detect Acquisition Mode
- Integrated DSP
- Extensive Processing and Measurement System
- Waveform Template Test
- Measurement Limit Testing
- Zoned Waveform Measurements
- FFT and Digital Filtering (high-, low-, band-pass and band reject)
- SCPI Message Based
- Fast Data Channel
- VXI*plug&play* WIN, WIN95 & WINNT Frameworks

Applications

- High Performance ATE Systems
- Analog and Mixed-signal Testing
- Template/Mask Compliance Testing
- Device Characterization
- Multi-channel Data Collection
- Research in High Speed Phenomena



TVS600A Series of Waveform Analyzers.

TVS600A Series Waveform Analyzers

HIGH PERFORMANCE INSTRUMENTS

The TVS600A-series combines leading edge digital oscilloscope technology with extensive processing and analysis capabilities, all in a compact VXI instrument. The modules readily address mixed signal test applications as well as rigorous characterization and research requirements. Built-in DSP and a rich portfolio of waveform processing and analysis functions rapidly reduce raw data to answers. On-board waveform template and mask testing efficiently evaluates entire waveforms for compliance. Measurement limit testing may also be performed within the instrument directing the system controller with simple pass-fail indications.

Individual instruments may be selected by bandwidth and channel count while overall analysis functions and command set remain common. Thus, users may establish a core test resource that easily adapts to future requirements for greater speed or higher channel density.

SIGNAL ACQUISITION SYSTEM

Digital Real-Time™ acquisition technology delivers simultaneous single-shot capture on four channels at rates up to 5 GS/s. Input features include 1 GHz bandwidth, sensitivity from 10 mV to 100 V full scale, 50 Ω or 1 MΩ impedance and TEKPROBE® BNC Interfaces to support passive, active, differential voltage and current probes as well as O/E converters.

Single-shot acquisition can be used for transient events or minimum capture time. Signal averaging can be applied to reduce noise on repetitive signals.

Peak detect mode recognizes events as narrow as 1ns anywhere within the sample interval and records their occurrence even at very low sample rates. This can be used to efficiently detect high frequency events while observing long time windows.

Auto-advance mode captures a sequence of transient events into discrete memory segments. The trigger time of each event is recorded and measurements can be made automatically across all events. This technique can be used to rapidly accumulate an ensemble of waveforms, extract several measurements (e.g., amplitude, risetime, width) and report their statistics (min, max, mean, st. dev.) while retaining individual trace data.

SOPHISTICATED TIMEBASE & TRIGGERS

The trigger and timebase systems provide sophisticated control over waveform acquisition. The TVS600A contain both main and delayed timebases. Acquisition can be held off by time delay from main, by counting events or a combination. This can maximize throughput by selectively digitizing only the portion of signal necessary. The trig-to-trig time measurement function returns the time between main- and delayed-timebase triggers providing a fast, accurate time measurement function.

See Tektronix on the World Wide Web: http://www.tek.com

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

VXI Waveform Analyzers

TVS621A • TVS625A • TVS641A • TVS645A

The TVS600A includes the sophisticated logic trigger system found in Tektronix high performance oscilloscopes. Pulse width, slew rate and edge-to-edge timing can be used to discriminate events for triggering. Logic states and patterns may also be designated. This system can efficiently detect missing pulses, runt pulses, glitches, setup or hold time violations and other anomalous events at hardware speeds.

EXTENSIVE PROCESSING & ANALYSIS

TVS600A waveform analyzers include on-board DSP, a sophisticated calculation expression system and an extensive function library to efficiently perform waveform processing and analysis.

Signal processing functions include waveform arithmetic, digital filtering and FFT. Arithmetic may be used to produce a power trace from voltage and current inputs or subtract a live trace from a stored reference. Digital low-pass, high-pass, band-pass or band reject filtering with user-specified frequencies and attenuations is included. This can dramatically improve the signal-to-noise ratio and increase measurement resolution and stability. Windowing functions and the FFT provide transformation to the frequency domain for spectral analysis.

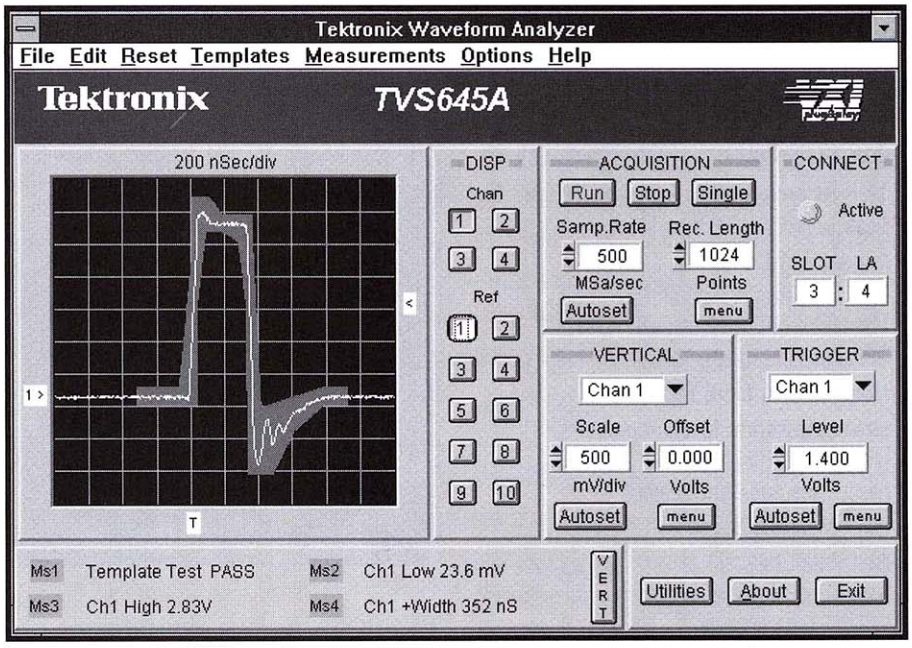
MEASUREMENT & CALCULATION SYSTEM

Over thirty measurement functions can be applied to reduce waveforms to scalar results. Measurements may be limited to specific regions allowing complex waveforms to be acquired once, followed by several measurements on different regions.

Calculation expressions may include both waveform data and measured values, facilitating complex analysis. For example, the mean value of a trace can be measured and subtracted prior to integrating the trace and measuring the resulting maximum value. This flexibility improves test throughput by allowing substantial data reduction within the instrument and without system controller interaction.

MEASUREMENT LIMIT COMPARISON

Further efficiency may be gained through on-board comparison to limits. Measurement functions can be tested against limits and reduced to a true/false indication. Results of several comparisons can be logically combined. For example, indicate TRUE if width is <1us or >5us, OR if amplitude is <4.9 V or >5.1 V.



VXIplug&play soft front panel application for WIN, WIN95, WINNT frameworks.

TEMPLATE & MASK TESTING

Entire waveforms can be tested against reference templates or masks. Templates consist of a max/min pair for each trace point to be tested while masks contain one or more two-dimensional regions of interest. The calculation system can be used to measure and rescale live traces or templates prior to comparison and time-alignment may also be accomplished within the instrument. Template and mask violations can be qualified on number of points out (in) or consecutive points out (in) to provide noise immunity. The user may also apply signal averaging, smoothing or digital filtering to improve the signal-to-noise ratio prior to comparison, maximizing test stability.

SYSTEM-CAPABLE INSTRUMENT

Several event-reporting and instrument synchronization features offer advantages to the VXI system-builder. The calculation system can report logical results of its testing by asserting Service Request (SRQ), initiating a VXI Event, issuing a trigger on the VXI backplane or reporting status in response to a query. Conversely, TTL or ECL trigger events can be used to arm and trigger the module.

The TVS600A command set is an extension of SCPI and includes enhancements such as Fast Data Channel protocol for high speed waveform transfers.

VXI*plug&play* INSTRUMENTATION

The TVS600A-series is fully compliant with the VXI*plug&play* WIN, WIN95 and WINNT frameworks. The hierarchical instrument driver provides access to all features of the instrument while grouping functions for ease of integration. Both 16-Bit and 32-Bit versions of the driver are included.

The soft front panel application provides a familiar interface for most commonly used instrument features. Autoset functions within the instrument and soft front panel simplify setup with new signals. Readout for up to four measurements is included and limit testing may be enabled for each. Waveform templates can be extracted from "golden waveforms" or downloaded. Templates can be adjusted prior to testing and failure criteria specified such as consecutive points outside.

VXI Waveform Analyzers

TVS621A • TVS625A • TVS641A • TVS645A

Characteristics

VERTICAL

Input Channels – Single-ended TEKPROBE® BNC Interfaces supporting Active, Passive, and Optical Probes. Multichannel acquisitions are acquired simultaneously.
TVS645A: 4 acquisition channels
TVS641A: 4 acquisition channels
TVS625A: 2 acquisition channels
TVS621A: 2 acquisition channels

Bandwidth – DC coupled.

TVS645A and TVS625A:

Full Scale Input	Bandwidth
100 mV to 10 V	DC to 1 GHz
50 mV to 99.5 mV	DC to 750 MHz
20 mV to 49.8 mV	DC to 600 MHz
10 mV to 19.9 mV	DC to 500 MHz
10.1 V to 100 V	DC to 500 MHz

TVS641A and TVS621A:

Full Scale Input	Bandwidth
10 mV to 100 V	DC to 250 MHz

Input Ranges – 10 mV to 100 V full scale in 1400 steps.

Vertical Resolution – 8 bits (256 digitized levels) Resolution can be increased with averaging or signal processing.

Input DC Gain Accuracy – ±1.5% for input ranges ≥ 20 mV full scale. ±2% for input ranges < 20 mV full scale.

Offset Range:

Full Scale Input	Offset Range
10 mV to 1 V	±1 V
1.01 V to 10 V	±10 V
10.1 V to 100 V	±100 V

Offset Accuracy

10 mV to 1 V	±(0.2% x |offset setting| + 1.5 mV +0.6% x full scale)
1.01 mV to 10 V	±(0.2% x |offset setting| + 15 mV +0.6% x full scale)
10.1 V to 100 V	±(0.2% x |offset setting| + 150 mV +0.6% x full scale)

Input Impedance – 1MΩ – 50 Ω Switchable.

Input Coupling – DC, AC, or Off.

Input Noise Filter – Full, 250 MHz, and 20 MHz Bandwidth user selectable.

Delay Between Channels (at same input range and coupling) – ≤100 ps.

Fiducial Input – ≤2.5 ns rise time superimposed on channel 1 acquisition, for time aligning multiple acquisition units. AC coupled signal path. Highpass time constant 5 ns, attenuates signal below 100 MHz.

SAMPLE RATE

Maximum Single-shot
TVS645A: 4 channels @ 5 GS/s
TVS641A: 4 channels @ 1 GS/s
TVS625A: 2 channels @ 5 GS/s
TVS621A: 2 channels @ 1 GS/s

Real Time Acquisitions – From "Maximum Single-shot Sample Rate" to 5 samples per second in a 1, 2.5, 5 selection sequence.

Record Length Maximum –
TVS645A: 4 channels to 15 K
TVS641A: 4 channels to 15 K
TVS625A: 2 channels to 15 K
TVS621A: 2 channels to 15 K

30,000 points per channel for samples rates of 10 MS/s to 5 S/s.

Record Length Range – 256 points to maximum in sequence of 256, 512, 1024, 2048, 4096, 8192, 15000.

Internal Time Base Reference – 10 MHz ±100 ppm.

External Time Base – 10 MHz over the VXI backplane CLK10 line.

Pre & Post Trigger Acquisition – Pre-trigger: (capture of data prior to the trigger event) 0% to ≈ 100% of record length.
Post-trigger: (capture of data after the trigger event) 0 seconds to 250 seconds.

Acquisition Modes – Normal, Average, Envelope, Auto-advance, Peak detect (>Ins).

Auto-advance Acquisition – 1087 records of 256 points to 34 records of 15 K points. Each record is Time Stamped to 125 ns resolution.

TRIGGERING

Sources – Internal (any channel), external, or VXI TTL and ECL trigger bus.

Types – Edge (main and delayed); Pulse (Width, Glitch, Runt, Slew Rate, Time Out); Logic (Pattern, State, and Setup & Hold Time Violation); Delay by Time – 16 ns to 250 secs; Delay by Events – 1 to 10,000,000 events with a maximum rate of 250 MHz.

Modes – Normal, Single, or Auto.

Range Internal – ±100% of Full Scale Input Range settable in steps of 0.1%.

Range External – ±1 V settable in steps of 6 mV.

Sinewave Sensitivity Internal – 3.5% Full Scale DC to 50 MHz increasing to 10% Full Scale at 1 GHz.

Sinewave Sensitivity External – 0.25 V DC to 50 MHz increasing to 1 V at 1 GHz.

Trigger Coupling –
Internal: DC, AC, LF Reject, HF Reject, and Noise Reject. External: DC – 50 Ω.

Trigger Slope – positive or negative.

Pulse Triggering –
Width: Trigger event time either in or out (user selected) of user specified time window. Glitch: Trigger event either greater than or less than (user selected) of user specified time window. Minimum Trigger Event Width: 1 ns. Rearm Latency: 2 ns + 5% of setting. Range: 1 ns to 1 sec.

Arm Input – Internal, External, or from the VXI TTL or ECL trigger bus. External (front panel connector) is TTL compatible and arms on switch closure to ground or 0 V level. 1 KΩ pull-up to +5 V provided.

OTHER FRONT PANEL CONNECTORS

Probe Compensation – Allows adjusting passive probes for use with 1 MΩ input impedance.

Reference Output – Allows verifying accuracy of internal amplitude and time sources.

Serial Interface – RS-232C DTE Interface provides an alternative computer interface for instrument control and waveform data transfer.

Performance Assurance –
Auto-Cal with user verifiable references.

Tested to IEEE-1057 Standard for Digitizing Waveform Recorders.

3 year product warranty.

Environmentally rugged.

ENVIRONMENTAL, PHYSICAL, AND SAFETY

VXI – "C" size, 2 slots wide.

Temperature – Operating: 0°C to +50°C.

Humidity – Operating: 95% relative (non-condensing) ≤ 30°C. 45% relative to +50°C.

Vibration – Operating: Mil-T-28800E Type III Class 5.

Shock – Nonoperating – 60 g, 11 ms, half-sine, 3 shocks per side.

Altitude – Operating: to 4.6 km (15,000 ft.).

Airflow – 6.6 l/s at 0.073 mm H_2O for 10°C rise.

Current Requirements –

TVS600A	TVS62XA	TVS64XA
+12 V	1.0 A	1.3 A
+5 V	8.0 A	11.0 A
–2 V	0 A	0 A
–5.2 V	2.7 A	4.6 A
–12 V	0.8 A	1.0 A

VXI Waveform Analyzers

TVS621A • TVS625A • TVS641A • TVS645A

Maximum Power – 106.5 W.

EMC –
EMC performance in VXI mainframe dependent with testing for the TVS600A Series tested in a Tektronix VX1410 mainframe.

Emissions (complies with) – Enclosure: EN55011 Class A for radiated emissions; AC Mains: EN60555-2 for power line harmonics EN55011 Class A for conducted emissions.

Immunity – Complies with EN50082-1 (IEC 801-3).

Immunity ESD – Complies with EN50082-1 (IEC 801-2).

Immunity Fast Transient – Complies with EN50082-1 (IEC 801-4).

Compliance – Complies with FCC CFR 47, Part 15 Subpart B, Class A.

Safety – Complies with UL 3111-1, CAN/CSA 22.2 no. 1010.1, and IEC 1010-1. Low voltage directive 73/23/EEC amendment 2 and EN61010 –1:1993.

COMMAND SET

Message Based – SCPI (Standard Commands for Programmable Instruments).

Fast Data Channel for waveform and measurement transfers.

10 complete instrument settings stored in the instrument (battery backed-up).

Low level (binary) settings query and return.

Instrument status signaling (e.g., operation complete, triggered, waveform data available) using the VXI TTL and ECL trigger bus.

Waveform Processing & Analysis –
Extensive waveform measurements extract time, amplitude and distortion characteristics of signals, including:

Min	Rise
Max	Fall
Low	+Width
High	–Width
Mid	Period
Mean	Frequency
Amplitude	+Duty Cycle
Peak-to-Peak	–Duty Cycle
Gain	Phase
Preshoot	Delay
Overshoot	Center of pulse
RMS	Cross
Std Dev	PCross
Area	Ncross
Cycle Area	Cycle RMS
Pos Area	Trig-Trig Time
Pos Cyc Area	Cycle Mean

Waveform Mathematics and Processing Include–

Add	Segment
Subtract	Window
Multiply	FFT
Divide	Digital Filter
Integrate	Smooth
Differentiate	Statistics
Abs Value	

Calculation Expressions –
Waveform math, transformations, filtering and measurements may be intermixed in algebraic expressions to act on acquired and reference waveform data.

"RMS (SMOoth (CHAN1 * CHAN2))"

Built-in limit testing returns true/false indication after comparison.

MEAN(CHAN1 OUTside 4.8..5.2)|
PWIDth(CHAN2 OUTside 2us..4us)

Segments of waveforms can be analyzed using start/stop measurement zone expressions or processed using the segmentation function.

"FFT(SEGMENT(CHAN1, 1us, 1024))"

The extensive calculation and measurement system simplifies test development and ensures accurate, reliable testing.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TVS645A
4 Channels, 1 GHz, 5 GS/s, 15 K Waveform Analyzer.

TVS641A
4 Channels, 250 MHz, 1 GS/s, 15 K Waveform Analyzer.

TVS625A
2 Channels, 1 GHz, 5 GS/s, 15 K Waveform Analyzer.

TVS621A
2 channels, 250 MHz, 1 GS/s, 15 K Waveform Analyzer.

Each includes: User Manual, Quick Reference Guide, and VXI*plug&play* WIN, WIN95 and WINNT Framework software.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data for Opt. C3.

Opt. D5 – Test Data for Opt. C5.

Opt. R5 – Repair warranty extended to cover five years.

PROBES (See page 438).
The TVS600A Series products include TEKPROBE® BNC Interfaces compatible with a wide range of passive, active and differential voltage probes, current probes, O/E converters and electrical communication adapters. Please refer to the Accessories section of this catalog for more information.

See Tektronix on the World Wide Web: http://www.tek.com

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

VXI Measurement

Features

VXI MEASUREMENT

- Wide Range of General Purpose Instruments, All VXI*plug&play* Compliant
- AC, DC, I, and Related Digital Multimeter Functions
- Frequency, Time interval, and Other Typical Timer Counter Functions

VX4101 DMM FEATURES

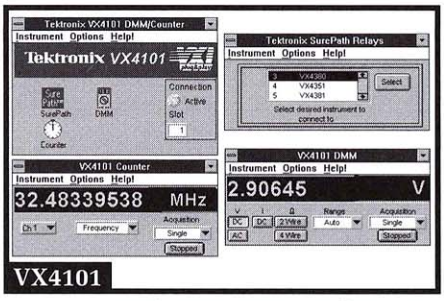
- Provides for More Than 500 Aperture Selections to Allow for Very Fine Control of the Accuracy vs. Speed Trade-offs
- DC/AC Volts, DC Current, & 2/4 Wire Resistance Measurements
- Auto-ranging and Auto-zero
- 4 Ksample On-board Buffer
- Industry Standard, Fast Data Channel to Move Data Rapidly to Host

VX4101 COUNTER FEATURES

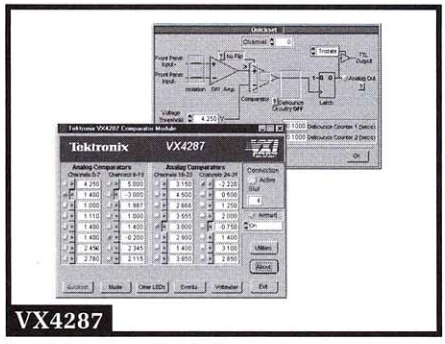
- 250 MHz Performance at 10 Digits/second Resolution
- Option 1C Increases Bandwidth to 500 MHz
- Option 2C is a Prescaler Input that Operates Up to 3 GHz
- Front End Counter Controls Include Filters, Attenuation, Gain, Offset, and Hysteresis

Applications

- General Purpose AC/DC Measurement
- General Purpose Time/Freq Measurements to 3 GHz
- Analog/Digital Comparison



5.5-Digit DMM/250 MHz Universal Counter.



32-CH Analog/Digital Input.

Measurement

Whether it's micro amps or hundred volt signals, your measurement subsystem is one of the most important functions of your VXI test and measurement system. Easy programming, well behaved and predictable operation, accuracy, and repeatable measurements are the key requirements of this kind of equipment. With Tektronix' many years of experience with user signals and demands, you are assured of satisfying performance in these areas, not to mention functions and specs that are hard to beat. As a founding member of both the VXI Consortium and VXI*plug&play* Systems Alliance, Tektronix is committed to making instruments that are built upon an open architecture and that are easy to integrate.

PRODUCTS

The newest product in the Tektronix measurement instrument portfolio is the VX4101 DMM/Counter/Relay Controller. Tektronix has designed an instrument that combines the functions of a 5.5-digit DMM, a 250 MHz Counter, and a SurePath™ Relay Controller. Key features for the VX4101 DMM and counter are listed in the first column.

The SurePath Controller is capable of controlling any combination of switching modules from the Tektronix SurePath family.

The VX4101 has a message-based SCPI command set that is IEEE-488.2 compatible making it easy to program. The VX4101 clearly sets a new price/performance benchmark for VXI instruments.

Tektronix also offers an array of standard measurement products that will meet your testing needs. The VX4234, a 4.5-digit DMM, is capable of performing your basic DMM measurements. The VX4237 is a high performance 6.5-digit DMM that includes a 1,000-reading buffer and an external trigger with programmable trigger delay capabilities. The 73A541 is a 10 MHz Counter/Timer that has all of the measurement functions associated with a universal counter as well as a time tagging function and automatic time interval relationship evaluation between two waveforms. The VX4286 and VX4287 are Analog/Digital Comparators that are capable of being programmed to process standard TTL logic levels or voltages of up to ±50 VDC.

THE SYSTEM VIEW

Tektronix manufactures its VXI measurement products and support software with the user in mind. You will find that VXI*plug&Play* drivers simplify and enhance test systems and test program development. As computer and operating systems evolve, so to will our VXI*plug&play* drivers. Tektronix is making a concentrated effort to make sure that all of our current products are compatible with WIN, WIN95, and WINNT frameworks. With Tektronix, you can expect solid, predictable instrument measurements and quick learning curves with our drivers and application software. This translates into faster system development times and more reliable systems once they are up and running.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(Except VX4234)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

VXI plug&play

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

MEASUREMENT INSTRUMENT SELECTION GUIDE

Instrument	Function	Key Specs	Key Features
VX4101	DMM/ Timer Counter	5.5 digits/250/ 500 MHz/3 GHz	High perf. Counter, DMM & SurePath™ Relay Controller in a single slot VXI module
VX4234	DMM	4.5 digits	Fast, fully guarded, AC & DC
VX4237	DMM	6.5 digits	High perf. 5AC/5 DC ranges
VX4286	A/D Comparator	32 CH	Single ended inputs
VX4287	A/D Comparator	32 CH	Differential Inputs
73A541	Counter	10 MHz	General purpose, time tag capabilities

VXI Sources

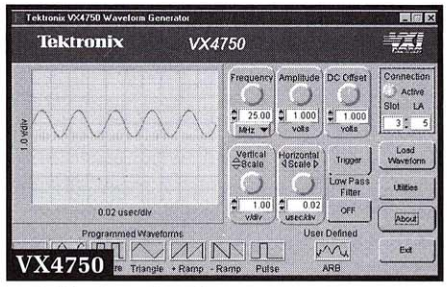
Features

VXI SOURCES

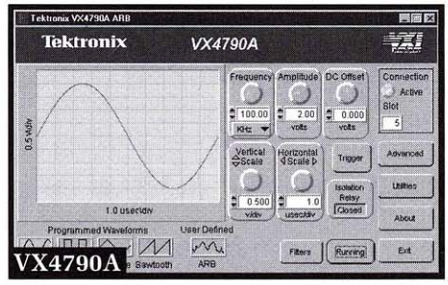
- Wide Range of General Purpose Instruments
- VXI*plug&play* Compliant
- High Output 16-Bit DACs
- Isolated Output, 25 MHz Function Generator
- 25 MSample/sec Arbitrary Waveform Generator with Deep Memory
- High Reliability/Excellent Stability and Accuracy

Applications

- Audio Signal Generation
- Sweep & Modulation Source
- Sensor Simulation
- Complex Signal Generation
- Bio-Electrical Signal Simulation



25 MHz Function Generator.



25 MS/s Arbitrary Waveform Generator.

Sources

When looking for information, it is always best to go to the source. Tektronix has long mastered the ability to design high performance, high value signal sources. This tradition continues into Tektronix' family of VXI signal sources.

One of the most common requirements of any automated test system is to simulate the operating environment the Unit Under Test (UUT) will encounter in actual use.

Whether you are involved with testing Defense Aerospace, Automotive, or Medical electronics, or just have the need to supply a unique analog stimulus to the UUT, Tektronix has a VXI-based signal source to meet your needs.

A SPECTRUM OF SOLUTIONS

Tektronix offers a wide array of VXI-based signal generation products optimized to meet the requirements of sophisticated automatic test system design.

Today's test requirements often demand more than just the standard waveforms. Margin testing and simulation of unique test signals call for the ability to design the waveform. An Arbitrary Waveform Generator (AWG) is the ideal choice for stimulus requirements that cannot be satisfied with standard sine, pulse, ramp or triangle waveforms. An AWG allows the test engineer to define the waveform as a series of separate voltages output at a fixed clock rate to create the analog signal digitally. The digital creation technique employed by AWGs provides the maximum amount of flexibility in tailoring the signal to the needs of the test scenario.

Function Generators provide spectrally pure waveforms for use in applications demanding low noise and standard wave shapes. Often, function generators are called on to be the modulation source in telecommunications or radio test systems. The VX4750 offers built-in state of the art modulation capabilities ranging from AM, FM and Phase Modulation to FSK and PSK.

IT'S JUST DC

One of the most common test needs is to supply precision DC voltages to the UUT. The need may be to simulate a sensor or transducer, provide an accurate voltage reference, or just provide power to the UUT in place of an expensive standalone power supply. The VX4730 fills all of these needs with 16-Bit precision, high current output and 12 independent channels.

PRODUCTIVITY

The Tektronix family of VXI signal sources offers enhancements to speed integration of your test system strategy. Innovative designs include deep AWG memory that permit loading of multiple waveforms at power up, eliminate the need to load new waveforms during test execution time, a costly and inefficient compromise. The isolated output of the VX4750 permits the high quality signal from the instrument to reach the UUT intact, reducing the effects of ground loops and the electrically noisy environment of the production test area.

These features and many more prove Tektronix' understanding and commitment to providing the best VXI signal source solution available.

See Tektronix on the World Wide Web: http://www.tek.com

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

SOURCES INSTRUMENT SELECTION GUIDE

73A270	Serial Pattern Gen.	2 Ch.	User Defined Serial Patt.
VX4342	Dual Resistance	4 Decades/Ch.	200 value changes/s
VX4730	D/A High Output	12 Ch.	±16 V, 400 mA
VX4750	Function Generator	25 MHz	Isolated Output, Modulation
VX4790A	Arb. Waveform Gen.	25 MS/s	Up to 1 MB Memory

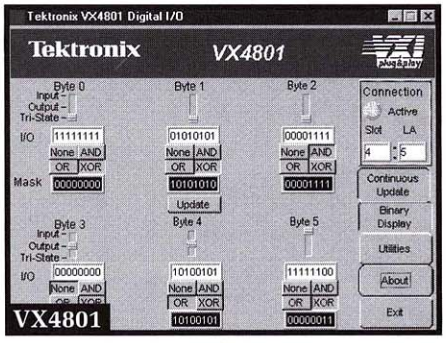
VXI Digital

Features

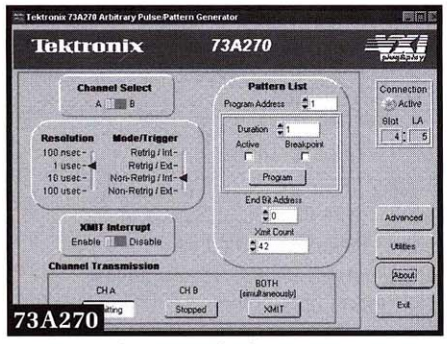
- TTL & CMOS Compatible Instruments
- Serial and Parallel Tools
- Cost Effective Basic Digital Pin Instruments with Simple to Use VXI*plug&play* Driver Support

Applications

- General Purpose Digital I/O
- Serial Bus Test Applications
- Digital Functional Testing
- Testing for IC, LCA, ASIC, etc.
- PCB Module or Card Testing



48-CH Isolated Digital I/O.



10 MHz Arbitrary Pulse/Pattern Generator.

Digital Testing

Due to the ever increasing amount of digital testing required for today's electronic products, modularity and functionality are two key aspects in designing today's test systems. VXI is ideal in addressing both of those requirements. Tektronix digital test instruments are designed to provide the maximum amount of functionality in a form factor that was developed as an industry standard for modularity. These instruments are used in applications ranging from manufacturing process control to aerospace and telecommunications. Like all of our instruments, the digital test instruments are designed to provide maximum reliability and maximum flexibility in test system design.

Products

VX4801 & VX4802

The extensive array of programmable features of Tektronix VXI digital test instruments is a major factor in the equipment's flexibility and makes test implementation a much easier task. For example, with both the VX4801 and VX4802 Programmable Digital I/O Modules, I/O lines can be independently configured in groups of 8-Bit bytes. Each byte can be programmed to be either an output or an input set. In addition, the VX4801 and VX4802 also provide software controls for definition of masks for input and output data, and the ability to define logic sense of input, output, and handshake lines.

VX4820

In many applications you must be able to send and receive parallel data on the same pins at a fairly fast rate. The VX4820 Digital Test Module provides digital stimulus and real-time response compare for up to 64 I/O pins per module. Testing is accomplished by sequencing through a series of up to 64 K test vectors. Each test vector contains all of the control information required to define each of the 64 I/O pins. Programming the VX4820 is made easy with the inclusion of Digital Toolbox software. Spreadsheet-like commands allow the user to quickly and easily define data patterns.

73A270

Tektronix' experience in serial avionics, automotive and communications buses has been the basis for the design of the 73A270 Serial Pulse Pattern Generator Module. The 73A270 is a two channel instrument where both channels can be individually programmed, and each channel contains a 1,600 event high speed location memory. Since the module allows programming of 1,600 duration values (not just 1,600 1's and 0's), very complex pulse trains of very long durations may be programmed.

All of the Tektronix digital instruments are message based to insure compatibility with the widest range of system controllers and to simplify the programmer's task of developing test software. The ease of programming message based instruments also shortens the time required for system expansion or modification. Many of these instruments allow you to save and recall several different test program setups for different applications. This reduces operating costs, since upgrading programming is quicker, and easier, and operator skill requirements are less restrictive.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(Except VX4820)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

VXI plug&play *For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.*

DIGITAL SELECTION GUIDE

Instrument	Function	Key Specs	Key Features
73A270	Prog Generator	2 Fast Serial Channels	Complex pulse trains
VX4801	Digital I/O Module	48 TTL/CMOS I/O's	Byte-by-byte programming
VX4802	Digital I/O Module	80 TTL/CMOS I/O's	User defined masks
VX4820	Digital Test Module	20 MHz test rate	32 or 64 switchable I/O channels

VXI Switching and Scanning

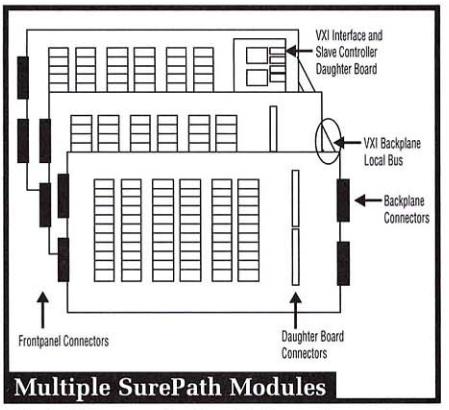
Features

VXI SWITCHING

- Relay Switching in SPST, SPDT, DPST, DPDT Configurations
- Relay Scanners Offer 1-wire, 2-wire, and 4-wire Configurations up to 240 Channels Per Module
- Relay Matrix with 256 Cross Points, Latching Configurations
- 1.3 GHz RF Multiplexer Offers Eight One x Four Multiplexers in a Single Slot
- Relay Drivers/Solenoid Controllers to 50 V DC and 300 mA

Applications

- RF Multiplexer
- Scanner/Multiplexer
- Relay Switch
- Matrix Switching
- Hi Current Switching
- Matrix and Relay Switching Up to 10 A



Block diagram of a SurePath configuration.

Tektronix SurePath™ Family of Relay Switching

The SurePath VXI switching architecture from Tektronix combines exceptional reliability, uncompromising performance, and increased channel density, with superb value to provide you with world-class signal switching and routing to meet the demands of manufacturing test applications.

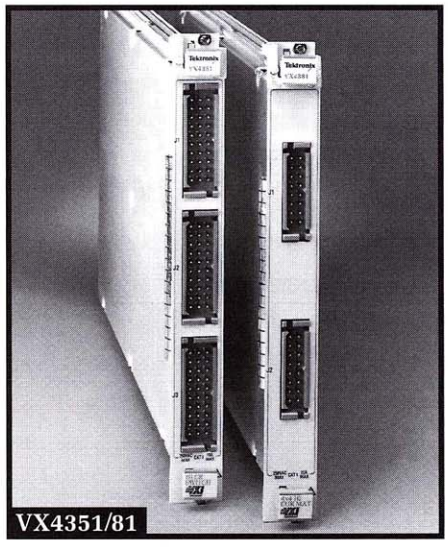
New to the SurePath family! The VX4351 40-Channel 10 A SPST Relay Switching Module and the VX4381 4x4 10 A Dual 1-wire Relay Matrix are two high-current VXI switching modules that extend the power handling capability of Tektronix' SurePath routing and switching technology from 2 to 10 A. The VX4351 and VX4381 allow automotive and defense/aerospace engineers to easily, accurately and reliably test at a high current without the need for externally mounted relays. Both modules feature interchangeable socketed relays that create a fully integrated test solution and improve ease of use.

The SurePath family consists of the following switching modules and a VXI Interface and Slave Control daughter board:

VX4320 RF MULTIPLEXER
Eight 1x4 RF multiplexers in a tree configuration give uncompromising RF switching performance and channel density.

VX4330 SCANNER/MULTIPLEXER
Provides high channel density and superior signal switching capability. Programmable configurations: 240 1-wire, 120 2-wire, or 60 4-wire channels.

VX4350 SPDT RELAY SWITCHING MODULE
64 channels of 2 A, 220 VDC/250 VAC switching provides superior Tektronix SurePath Family of Relay Switching application flexibility.



VX4351/81 High Current Switches.

VX4351 40-CH 10 A SPST RELAY SWITCHING MODULE
40 channels of 10 A, SPST, 250 VDC/VAC switching provides unmatched Tektronix SurePath Family of Relay Switching application flexibility. Programmable as a 20 channel DPST configuration.

VX4380 256-CROSS POINT SWITCH MATRIX
Configure as four individual 4x16, or single 16x16, 8x32, or 4x64 matrices. Other two- and four-wire configurations including multi-module applications are possible.

VX4381 4X4 10 A DUAL 1-WIRE RELAY MATRIX
Programmable as two individual 4x4 10 A, 1-wire switch matrices, or a single 4x4 10 A, 2-wire switch matrix. A true non-blocking switching matrix that allows users to connect any row to any column.

THE SUREPATH FAMILY
SurePath modules use an innovative relay control architecture to reduce cost, improve reliability, simplify programming, and speed test program execution. Each SurePath module is controlled over the VXI local bus by a VXI Interface and Slave Control daughter board. The daughter board can control up to twelve SurePath modules. Only one daughter board is required per VXI chassis. However, maximum flexibility in test system design is ensured when each SurePath module is fitted with the optional daughter board. This results in fully independent operation. Whether you choose to implement your SurePath switching subsystem with a single or multiple daughter boards, there is no loss of throughput or execution speed.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

VXI plug&play

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

VXI Switching and Scanning

64-CH SPDT Relay Switching.

CABLE ACCESSORIES

The SurePath family offers an extensive array of system integration accessories that will enable you to fabricate your own cables or select a pre-configured cable assembly from our catalog. Available accessories include connector kits, crimp and disassembly tools, and fully documented cable assemblies of various lengths.

QUALITY

All SurePath modules have been rigorously tested and certified to Mil-T-28800E, IEC 1010, UL 3111, and EC92 quality standards. SurePath modules are IEEE-488.2, SCPI, and VXI*plug&play* compliant.

SWITCH CONFIGURATIONS

In virtually all automatic test applications, the test engineer must evaluate signal routing and switching requirements. The VXI platform or architecture offers a variety of integration options for the test engineer to consider. Tektronix offers a wide array of different switching solutions ranging from matrices, scanners, multiplexers, RF switching, and an assortment of general purpose independent relay switches. Tektronix offers a switching solution for virtually any ATE requirement needing high density, excellent signal fidelity, and ease of integration and programming. All of our relay switching products offer a full line of accessories and cable assemblies. A pre-wired cable can significantly reduce your system integration efforts by freeing up test engineering resources to concentrate on "Value Added" contributions.

VXI SWITCHING AND SCANNING SELECTION GUIDE

Type	Configuration	No. of Channels	$I_{switch\ max}$	V_{max} DC/AC
Relay Switching				
VX4350	SPDT	64	2 A	220/250
VX4351	SPST	40	10 A	250/250
VX4353	SPST	32	5 A	48/250
VX4356	DPDT	20	5 A	48/250
VX4357	SPDT	32	5 A	48/250
Scanner/Multiplexer				
VX4330	Programmable	120 2-wire	2 A	220/250
Matrix				
VX4380	Selectable	256-cross Points	2 A	220/250
VX4381	Programmable	32	10 A	250/250
RF Switch				
VX4320	Tree	8 groups of 1x4	10 W	28 V DC
Relay Control				
73A308	Open Collector	80 outputs	300 mA	50 V DC

SCANNER/MULTIPLEXER

The VX4330 can be programmed to allow one channel to be closed at a time. An analogy for its operation is a rotary switch that allows you to select one of many positions. When the command to close a channel is received, any channel currently closed is opened and then the commanded channel is closed. This is called "break-before-make" operation. In multiplexer mode, the VX4330 allows multiple channels to be opened or closed. Tektronix offers 2-wire and 4-wire scanners and multiplexers.

GENERAL PURPOSE RELAY SWITCHING

The switch card, which provides independent switches, is the most versatile. A switch card can be manually configured to act like a scanner or a matrix card. It can also be programmed to have any number of switches open or close at any given time. Each switch on the card is controlled by individual Open and Close commands.

Tektronix offers two versions of general purpose relay switching modules – high density or high current. The VX435x-Family (VX4350, VX4351, VX4353, VX4356, and VX4357) gives the highest performance in a variety of switching configurations. Contact ratings up to 1,000 VA AC, 90 WDC are available in SPST, DPDT, SPDT, and DPST configurations. The VX4351 offers 40 channels of 10 A relay switching.

SWITCH MATRIX

A switch matrix module has a number of switches pre-configured in columns and rows. Complex switching systems can be assembled using combinations of matrix switch modules.

The VX4380 (2 A) and VX4381 (10 A) provide programmable cross-point type relay matrices for signal connection between any row and any column.

RF SWITCHING

The VX4320 is a single-slot C-size VXI module intended to switch RF and high-frequency signals. The VX4320 provides eight independent channel groups, each configured as a one-by-four coaxial multiplexer with a 50 Ω characteristic impedance.

RELAY DRIVERS

The 73A308 Relay Driver Module provides 80 open collector output drivers for control of external relays. Each channel can sink up to 300 mA at up to 50 V.

SIGNAL CHARACTERISTIC CONSIDERATIONS

When selecting the best solution to your switching needs, you must consider the characteristics of the signals you need to switch. Some signal characteristics you may need to consider when selecting a switching card are:

- Maximum Voltage
- Maximum Current
- Minimum Signal Level
- Signal Path Impedance
- Signal Frequency
- Number of Channels

Please refer to the Switching/Scanning Selection Guide to aid you in making the best choice for your application.

VXI Avionics

Features

VXI AVIONICS TEST

- MIL-STD-1553 Bus Simulators and Bus Monitors
- ARINC 429 Receiver/Transmitter
- ARINC 629 Multi-terminal Simulator
- Discrete I/O and Aircraft Transducer Simulation

AVIONICS PRODUCT SELECTION GUIDE

Type	Description	Applications
VX4428	Quad ARINC 429 Transmitter and Receiver	Test and control LRUs via ARINC 429 Transmitter and Receiver
VX4469A	ARINC 629 Simulator with Enhanced Error Injection	Up to 3 terminals with full error injection Emulate multiple terminals in real time
73A455	Dual-channel MIL-STD-1553	Simulate bus controller, remote terminal, or bus monitor

Avionics

Tektronix has a long history of commitment to aerospace and avionics testing. This year, Tektronix offers a wide range of products and services tailored to the avionics community. Whether you are a self-integrator of avionics ATE systems or need avionics test system integration services and expertise, Tektronix has the experience, products, and services to get you off the ground quickly and reliably.

Tektronix offers the widest range of VXI-based instrumentation and communication interfaces specifically designed for avionics test and simulation. Our extensive catalog includes ARINC 429, ARINC 629, and MIL-STD-1553 VXI modules. These products are used by airlines and depot repair facilities worldwide. Tektronix VXI instruments are included in avionics ATE systems supplied by leading avionics and aircraft manufacturers worldwide.

ARINC 629

In support of Boeing's new jetliner, the B777, Tektronix is offering the VX4469A ARINC 629 Simulator with Enhanced Error Injection.

The VX4469A is our third generation ARINC 629 tester whose enhancements are a direct result of our experience and customer feedback on our earlier products. The VX4469A combines all of the functions of the proven VX4469 with new error injection capability you need to get your test system flying. The VX4469A provides you with an advanced tool for ARINC 629 communication, bus traffic simulation, and bit, word and message level error injection. The VX4469A provides the maximum visibility into your LRU's ARINC 629 interface.

ARINC 429

Used on virtually every commercial passenger aircraft, ARINC 429 is the main serial communication interface between avionics units. The VX4428 offers unsurpassed ARINC 429 test and communication capability. The VX4428 four channel transmitter and receiver module provides full error injection and detection required for avionics automatic test systems.

MIL-STD-1553

The 73A455 is a standard in the industry for testing today's modern defense avionics units. More than a Mil-Std-1553 communication interface, th 73A455 offers full test capability whether your application requires bus controller or remote terminal simulation. Offering dual redundant functionality, the 73A455 provides two fully independent channels with full error injection and detection, programmable amplitude and receive thresholds. Knowledgeable application engineers are available to consult on your avionics test applications and solutions.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

VXI plug&play

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

VXI Slot 0 Modules and Controllers

Wide Selection

Tektronix offers a wide selection of Slot 0 modules and controllers. Customers can choose from IEEE-488, MXI Slot 0 modules, or Embedded PC-compatible controllers. These products are manufactured by National Instruments and support LabWindows/CVI and LabVIEW software.

COMPATIBILITY

Each Slot 0 module and controller sold by Tektronix fully supports VXI Revision 1.2, 1.3, and 1.4 instruments. This backward compatibility means that you are not forced to replace instruments manufactured to different VXI revision levels.

Independence of the instrument from the controller is in keeping with the intent of the open architecture of VXIbus. In addition, it seems to be an obvious requirement for any new Slot 0 module or controller. Otherwise customers are forced to replace their existing instruments when purchasing the latest Slot 0 module or embedded controller. This can be expensive both in terms of new hardware and potential software changes.

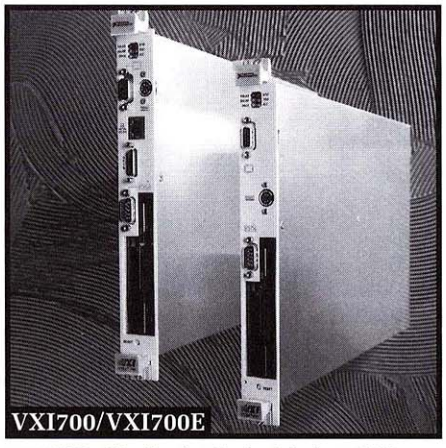
Tektronix is committed to the open architecture of VXIbus. The easy to program, message based Tektronix instruments accommodate a wide selection of Slot 0 modules and controllers. Likewise, the Slot 0 modules and controllers sold by Tektronix accommodate a wide variety of instruments. The independence of the instruments from the Slot 0/controller maximizes both current and future test system flexibility.

IEEE-488 (GPIB)

The most popular Slot 0 selection for VXIbus systems is the IEEE-488 Slot 0 module. This module integrates a VXIbus mainframe nicely into an existing IEEE-488 system. The message based ASCII commands of Tektronix instruments program just like monolithic IEEE-488 instruments, greatly reducing the learning curve for customers who are new to VXI.

The VXIGPIB Slot 0 is a low cost Slot 0 module and has more than adequate performance for most test needs. By conforming to the industry standard IEEE-488, it gives the maximum number of choices and flexibility for an external computer.

Another benefit of utilizing an external controller is that the VXIbus mainframe can be turned off or rebooted without disrupting the controller. This is especially useful in design and development applications.



100 MHz Single-slot Embedded 486DX4 Controllers.

Tektronix also supplies PC plug-in IEEE-488 cards to interface with IEEE-488 VXIbus Slot 0 modules.

MXIBUS

The Multisystem Interface bus (MXIbus) is an open industry standard that has been endorsed by a variety of vendors and users, including Tektronix. This provides a high speed communications link that is not proprietary or tied to one particular vendor.

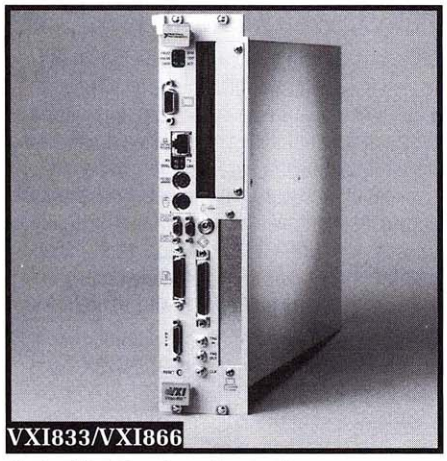
The MXIbus Slot 0 module provides a high speed interface between an external controller and a VXIbus mainframe.

MXIbus also allows of the VXIbus to multiple mainframes. The MXIbus module can be added to an embedded configuration to extend the VXIbus mainframe. MXIbus Slot 0 configurations can be easily daisy chained.

Tektronix sells the MXI2PCI VXI-MXI Interface Kit for PCI-based computers as well as the MXIWIN Standard VXI-MXI interface kit for PC AT-based computers. The kits include the MXIbus PC card and the VXI-MXI Slot 0 module.

EMBEDDED CONTROLLERS

Embedded controllers allow a VXIbus system to be operated as a standalone test system. The direct access to the VXIbus backplane gives the embedded controller fast access to VXIbus instruments. Embedded controllers can also be used to control other VXIbus mainframes or IEEE-488 monolithic instruments.



Embedded Pentium Controllers.

Tektronix offers a range of embedded controllers with different price and performance levels. The VXI700 Series of embedded VXI controllers uses state-of-the art technology and packaging to create a solid, PC-based foundation for controlling VXI systems in a single slot.

The VXI700 and VXI700E controllers are based on the 100 MHz 80486 DX4 microprocessor. Both configurations are available with a built-in floppy disk and standard desktop PC interfaces, including keyboard and one serial port that can be used for a mouse. The "enhanced" VXI700E version also provides a front panel IEEE-488.2 compatible GPIB controller interface and 10baseT Ethernet.

The VXI800 Series controllers use an integrated design centered on the high-performance peripheral computer interface (PCI) bus, allowing for a modular design. This modular architecture places the microprocessor and system memory on a PCI-based daughtercard, permitting the same motherboard and enclosure to be used for both products (the modular PCI-CPU card determines the particular model). For example, the VXI833 uses a 133 MHz Pentium CPU card and the VXI866 uses a 166 MHz Pentium CPU card. The CPU module is easily accessible, as are its memory sockets, for easy installation of additional field memory.

EMBEDDED CONTROLLERS SELECTION GUIDE

Instrument	RAM	Hard Disk	MHz	Microprocessor
VXI700	16 MB to 48 MB	800 MB	100 MHz	80486DX4
VXI700E	16 MB to 48 MB	800 MB	100 MHz	80486DX4
VXI833	16 MB to 48 MB	800 MB	133 MHz	Pentium
VXI866	16 MB to 48 MB	800 MB	166 MHz	Pentium

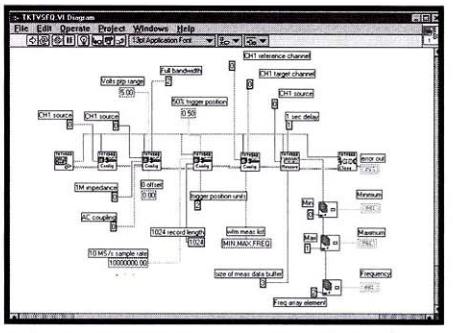
VXI Application Development Software

LabVIEW®/LabWindows®/CVI*1

Software plays a vital role in developing automated instrument control systems. The software you use in these systems spans a broad range of functionality, from device drivers for controlling specific hardware interfaces to application software packages for developing complete systems. The quality and flexibility of the software you use to develop your instrumentation systems will ultimately determine your system's overall quality and usefulness.

Tektronix offers two application software packages: LabVIEW for Windows 95/NT/3XX and LabWindows/CVI for Windows 95/NT/3XX. LabVIEW and LabWindows/CVI supply you with all the software development tools you need to integrate your instrumentation system using off-the-shelf, standard computers and instrumentation hardware.

LabVIEW and LabWindows/CVI also give you tools to control instruments, acquire data, analyze data, and present data on screen or in computer hardcopy format. By using these packages, you can reduce your system development time, create higher quality programs, and make your system easier to modify and maintain.

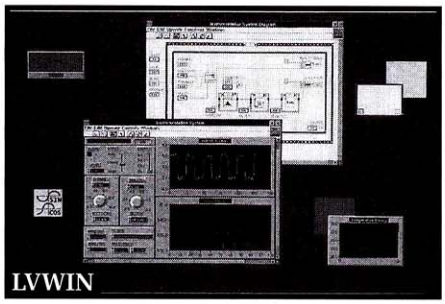


LabVIEW Program using a VXIplug&play Instrument driver.

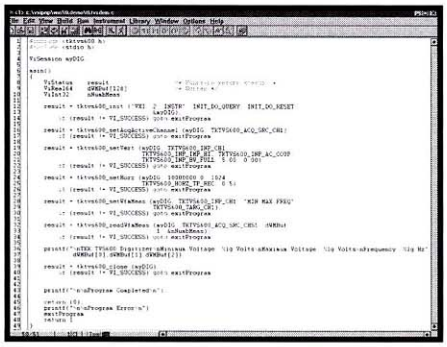
You can use application software to develop each of the three primary elements of your system – data acquisition, data analysis, and data presentation. Many vendors offer application software packages that focus on only one of the elements, or that are well suited for a particular application. However, most applications require software for all three elements of the system. Therefore, LabVIEW and LabWindows/CVI application software packages address all three of these elements.

DISTINGUISHING BETWEEN LABVIEW AND LABWINDOWS/CVI

The basic difference between LabVIEW and LabWindows/CVI is the programming methodology. Graphical programming in LabVIEW represents a revolutionary new approach to programming. LabVIEW combines the latest operating system technology with object-oriented programming techniques to give you the simplicity of nonprogramming systems with the flexibility of a standard programming language such as C or Pascal.



LabVIEW® for Windows.

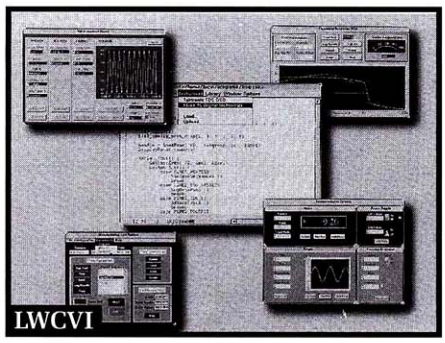


LabWindows/CVI Program using a VXIplug&play Instrument driver.

LabVIEW offers an innovative programming methodology in which you graphically assemble software modules called Virtual Instruments (VIs). You build VIs to acquire data from programmable instruments and then analyze the data and present the results through graphical user interfaces (GUIs).

LabVIEW gives you an alternative to cumbersome text-based programming. If you are looking for a better way to program your instrumentation system without sacrificing performance – LabVIEW is exactly what you have been looking for.

LabWindows/CVI is a complete ANSI C integrated programming environment for building instrumentation systems for ATE, test and measurement, data acquisition, and process monitoring and control applications.



LabWindows®/CVI for Windows.

Built around the hardware control libraries for GPIB, VXI and serial instrumentation are extensive analysis and user interface programming tools, so you can build your entire application within LabWindows/CVI.

Your decision between LabVIEW and LabWindows will most likely be based upon your programming preferences. If you have little or no programming experience, LabVIEW is the best product for you. Experienced programmers also benefit from LabVIEW because of its quick development times and flexibility for sophisticated program development. If you are already a C or Basic programmer, regardless of your experience, you should consider LabWindows/CVI.

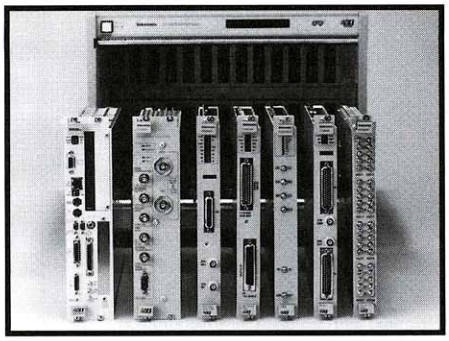
INSTRUMENT DRIVERS

At the core of all test and measurement systems are the instrument drivers. Instrument drivers, in fact, are the most important element of programming VXI instrumentation. Instrument drivers drastically reduce software development costs because developers do not have to spend time programming the low level instrument control details. The drivers can also be reused in a variety of systems and configurations.

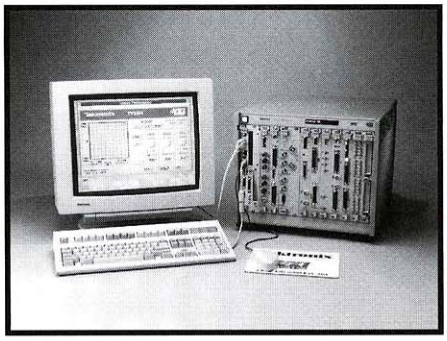
Both LabVIEW and LabWindows/CVI are compatible with VXI*plug&play* WIN, WIN 95 and WINNT framework instrument software. This means Tektronix VXI*plug&play* instrument drivers are ready to be used in LabVIEW or LabWindows/CVI program development. Each Tektronix VXI*plug&play* instrument driver is delivered in 'C' source code, so you have the ability to create your own unique instrument driver. You can download Tektronix VXI*plug&play* instrument software from the Tektronix Web site (http://www.tek.com/Measurement/vxidrivers).

**1 LabVIEW and LabWindows are registered trademarks of National Instrument Corporation.*

VXI Configuration Services



Tektronix Instruments.



Mainframe Configuration Services.

Configuration Services

As a leading manufacturer of computer controlled test equipment, Tektronix understands that equipment suppliers must provide additional support and services to allow you to get your test system up and running in a timely, cost effective manner. This is especially true for VXI instruments and modules. The designed in modularity of the architecture forces you to integrate a system for even the simplest of test requirements. More complicated systems can require a more comprehensive engineering effort that can take resources away from the development of your primary products.

To assist you in your test system development process, Tektronix has established a configuration service that is designed to save you time and money.

THE PRODUCTS

"Just send me the Instruments!"

For our customers who are truly self-integrators and need no assistance in developing or fabricating their test systems, Tektronix will continue to provide state-of-the art instrumentation that has been designed to satisfy your testing requirements. In addition, Tektronix complements its products by providing VXI*plug&play* WIN, WIN NT, WIN95 Framework drivers which are designed to simplify the integration of our instruments into you test platforms.

MAINFRAME CONFIGURATION SERVICES

"I need a little help in developing my basic system."

Our Mainframe Configuration Services are designed for customers who may need some help configuring their systems. The program is set-up to make it easy for you to choose the instruments that you need and bundle them with a Tektronix IntelliFrame® Mainframe and a Slot 0 Controller. You can also arrange to have Tektronix integrate the system for you, setting module addresses and, when an embedded controller is added, loading the drivers and soft front panels.

CUSTOM SYSTEMS

"I don't have the time or the resources to develop my own test system"

Although Tektronix does not build Custom Turnkey systems, we do provide an alternative which we feel is a more cost effective solution for our customers. Tektronix has developed a network of Synergy Partners*[1] who provide custom integration services. The partners are selected for their expertise and capabilities in software development, turnkey solutions, industry expertise, and post-sale support. By relying on our Synergy Partners to provide custom services, Tektronix can focus its attention on developing test instrumentation and software. This solution provides you, the customer, the best of both worlds, an instrument manufacturer that is focused on providing the latest technological advances in instrumentation and a full system integrator that has experience in developing systems related to your products and applications.

THE PROCESS

Your local Account Manager can help you define your requirements and determine which services would be best for you. The Account Manager can help you order our mainframe configuration services or provide you with information about our synergy partners.

Tektronix is committed to giving you the options you need to make the right choices when designing your test systems. Whether it's instruments, software products, or configuration services, Tektronix provides reliable, cost effective solutions to your testing requirements.

[1] The current list of VAR (Value Added Reseller) Synergy Partners can be found on the Tektronix WWW web page at: http://www.tek.com/Measurement/Sales/var/index.html

VXI Cables and Connectors

Features

- Cables and Connectors
- Module to Cable Cross Reference

SELECTION GUIDE

CABLES AND CONNECTORS

Cable	Cards Used With
VX1630	VX4330
VX1630S	VX4330 160-Pin Connector Kit
VX1640S	VX4356
VX1650	VX4350
VX1650S	VX4350 96-Pin Connector Kit
VX1657P	VX4801 VX4802
VX1657S	VX4357
VX1658P	I/O Cables VX4244
VX1660	VX4380
VX1661	VX4380
VX1662	VX4380
VX1663	VX4380
VX1664	VX4380
VX1665	VX4380
VX1666	VX4380
VX1667	VX4380
VX1727	VX4353
VX1729*[1]	VX4101, VX4320, VX4790A SMB to BNC
VX1730*[1]	VX4101, VX4320, VX4790A SMB to SMB
VX1731*[1]	VX4101, VX4320, VX4790A SMB to SMB
VX1732	VX4730
VX1733	VX4286
VX1734	VX4287
VX1735	VX4287
VX1742P	VX4240 VX4801
VX1744	VX4780
VX1745	VX4780

*[1] *Available in 10 ft., 3 ft., 1 ft., 7 in. lengths.*

CABLES AND CONNECTORS

Cable	Cards Used With
VX1746	VX4244
VX1760	VX4101 Adapter Cable (SMA to BNC)
VX1780P	VX4244, VX4801, VX4802, 73A455 50-Pin D Plug (Connector & Hood)
VX1780S	VX4244, VX4286, VX4287, VX4353, VX4357, 73A308, 73A451, 73A452 50-Pin D Socket (Connector & Hood)
VX1782P	VX4240, VX4428, VX4469A, VX4801, 73A270 25-Pin D Plug (Connector & Hood)
VX1783P	VX4428 15-Pin D Plug (Connector & Hood)
VX1783S	VX4237 15-Pin D Socket (Connector & Hood)
VX1784P	VX4101, VX4730, VX4750 9-Pin D Plug (Connector & Hood)
VX1784S	VX4342 9-Pin D Socket (Connector & Hood)
VX1785S	VX4356 44-Pin D Socket (Connector & Hood)
VX1786P	VX4287 10-Pin Circular Plug (Connector & Back Shell)
VX1786S	VX4287, VX4428 10-Pin Circular Socket (Connector & Back Shell)
73A642	73A308
73A734	73A270
012-1379-00	VX1410 with Option 1M
012-0991-01	1 M VXIGPIB Cable
012-0991-00	2 M IEEE-488 Cable
012-0991-02	4 M VXIGPIB Cable

VXI Cables and Connectors

MODULE TO CABLE CROSS REFERENCE

Model Number	Suggested or Required Cable or Connector	Optional Cable or Connector	Quantity Required
VXIGPIB	012-0991-00/01/02	–	1
VXOA41	*5	–	–
VX1410 w/ Opt. 1M	012-1379-00	–	1
VX4101	–	VX1760	1
VX1729	*5	*5	*5
VX1730	*5	*5	*5
VX1731	*5	*5	*5
VX1760	*5	*5	*5
VX4234	Std. Banana Plugs	Wire to Binding Posts	6 max
	Std. BNC*2	–	1
VX4237	15-Pin D	–	1
	Std. BNC*2	–	1
VX4240	Std. BNC	–	2
	VX1782P*2	VX1742P*2	1
VX4244	VX1657P	VX1780P	1
	VX1746	VX1780S	1
VX4286	VX1733	VX1780S	2
	Std. BNC*2	–	2
VX4287	VX1734	VX1780S	2
	VX1735	VX1786S	1
VX4320	VX1729		
	VX1730		
	VX1731		
VX4330	VX1630	VX1630S	2
VX4342	VX1784S	–	1
VX4350	VX1650	VX1650S	2
VX4353	VX1727	VX1780S	2
VX4356	VX1640S	VX1785S	3
VX4357	VX1657S	VX1780S	2
VX4380	VX1660	VX1630S	*5
	VX1661	VX1630S	*5
	VX1662	VX1630S	*5
	VX1663	VX1630S	*5
	VX1664	VX1630S	*5
	VX1665	VX1630S	*5
	VX1666	VX1630S	*5
	VX1667	VX1630S	*5

MODULE TO CABLE CROSS REFERENCE

Model Number	Suggested or Required Cable or Connector	Optional Cable or Connector	Quantity Required
VX4385	VX1780S	–	2
		–	1
VX4428	VX1782P	–	1
	VX1783P	–	1
	VX1786P	–	1
VX4469A	VX1782P	–	1
	VX1785S	VX1769	1
VX4730	VX1732	VX1784P	4
VX4750	Std. BNC	–	6 max
	VX1784P*2	–	1
VX4780	VX1744	–	1
	VX1745	–	1
VX4790A	VX1729/	VX1730*2	6 max
VX4801	VX1657P	VX1780P	1
	VX1742P	VX1782P	1
VX4802	VX1657P	VX1780P	2
VX4820	Pod Connectors*1	–	2 max
	Std. BNC*2	–	2 max
73A270	Std. BNC	–	6 max
	73A734*2	VX1782P	1
73A308	73A642	VX1780S	2
73A451	–	VX1780S	–
73A452	–	VX1780S	–
73A455	VX1780P	–	1
	TRB*3	–	4
73A541	Std. BNC	–	6 max
73A850	Not Applicable	–	–
73A851A	Not Applicable	–	–

**1 Cable is supplied as standard equipment.*

**2 Cable connects only to Auxiliary signals.*

**3 Triaxial, male, three lug bayonet connector.*

**4 See cable details for order information.*

**5 Application dependent.*

VXI Product Summary

STANDARD PRODUCT SUMMARY

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

MAINFRAMES

VX1410 – IntelliFrame® 13-slot Mainframe.

VX1411 – Low Cost 13-slot Mainframe.

VX1406 – Portable 6-slot Mainframe.

DIGITIZERS AND WAVEFORM ANALYZERS

TVS645A – 8-Bit, 4-CH, 1 GHz, 5 GS/s, 15 K Waveform Analyzer.

TVS625A – 8-Bit, 2-CH, 1 GHz, 5 GS/s, 15 K Waveform Analyzer.

TVS641A – 8-Bit, 4-CH, 250 MHz, 1 GS/s, 15 K Waveform Analyzer.

TVS621A – 8-Bit, 2-CH, 250 MHz, 1 GS/s, 15 K Waveform Analyzer.

VX4240 – 12-Bit, 10 MS/s, Waveform Digitizer/Analyzer.

VX4244 – 16-Bit, 16-CH, 200 KS/s Digitizer.

VX4570 – Mass Storage Controller.

VX4GBD – 4 GB SCSI Hard Disk Drive.

VX4780 – Signal Conditioner.

DCS1000 – Data Collection System.

MEASUREMENT

VX4101 – 5.5 Digit DMM/250/500 MHz Universal Counter.

VX4234 – 4.5 Digit Digital Multimeter.

VX4237 – 6.5 Digit Digital Multimeter.

VX4286 – 32-CH Analog/Digital Input.

VX4287 – 32-CH Analog/Digital Input.

73A541 – 10 MHz Universal Digitizing Counter.

STIMULUS AND SOURCES

VX4790A – 25 MS/s Arbitrary Waveform Generator.

VX4750 – 25 MHz Function Generator.

VX4730 – 12-CH Digital/Analog Converter.

VX4342 – Dual Resistance Programming.

SWITCHING AND SCANNING

VX4320 – RF Multiplexer.

VX4330 – 120-CH Scanner/Multiplexer.

VX4350 – 64-CH SPDT Relay Switching.

VX4351 – 40-CH 10A SPST Relay Switching.

VX4353 – 32-CH SPST Relay Switching.

VX4356 – 20-CH DPDT Relay Switching.

VX4357 – 32-CH SPDT Relay Switching.

VX4380 – 256 Cross Point Relay Matrix.

VX4381 – 4x4 10A Dual 1-Wire Relay Matrix.

73A308 – 80 Relay/High Voltage Logic Drivers.

DIGITAL

VX4801 – 48-CH Isolated Digital I/O.

VX4802 – 80-CH Digital I/O.

VX4820 – 20 MHz Digital Test.

VXP64C – 32-PIN, 64 Kvector CMOS Memory Pod for the VX4820.

VXP64T – 32-Pin, 64 Kvector TTL Memory Pod for the VX4820.

73A270 – 10 MHz Arbitrary Pulse/Pattern Generator.

ARINC INTERFACES

VX4428 – ARINC 429 Quad Transmitter/Receiver.

VX4469A – ARINC 629 Simulator w/Enhanced Error Injection.

MIL-STD-1553A/B INTERFACES

73A455 – 2-CH 1553A/B Bus Simulator.

OPTICAL ATTENUATOR

VXOA41 – Programmable Optical Attenuator.

DEVELOPMENT MODULES

73A451 – VXI Message-Based Development Module.

73A452 – VXI Blank Wire Wrap Module.

ADAPTER AND EXTENDER MODULES

73A850 – Extender Card.

73A851A – VME/VXI Adapter.

014-0070-00 – C-size to D-size Mainframe Adapter Module.

SLOT 0 MODULES AND CONTROLLERS

VXI866 – 166 MHz Embedded Pentium Controller.

VXI833 – 133 MHz Embedded Pentium Controller.

VXI700/VXI700E – 100 MHz Single-slot Embedded 486DX4 Controllers.

MXI2PCI – VXI-MXI Interface Kit for PCI.

MXI2VXI – MXI-2 Slot 0 Module.

MXIWIN – VXI-AT2010 MXI Kit Interface for AT.

MXIEXT – Slot 0 Module.

VXIGPIB – GPIB-VXI/C Slot 0 Controller.

IEEE-488 INTERFACE CARDS FOR PC COMPUTERS

S3FG210 – GPIB-PCII/IIA Interface Card.

S3FG220 – AT-GPIB/TNT Interface Card.

APPLICATION DEVELOPMENT SOFTWARE

LVWIN – LabVIEW for Windows 3.1x.

LVWIN95 – LabVIEW for Windows 95 Full Development System.

LVWINNT – LabVIEW for Windows NT Full Development System.

LVWINAB – LabVIEW Application Builder.

LVWINTE – LabVIEW Test Executive.

LWCVI – LabWindows/CVI for Windows 3.1x.

LWCVI95 – LabVIEW for Windows 95 Full Development System.

LWCVINT – LabVIEW for Windows NT Full Development System.

LWCVITE – LabWindows/CVI Test Executive.

MEASUREMENT SERVICE OPTIONS

Call your local Tektronix representative for a full list of service options.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

VXI plug&play

For product detail, request a VXI CD-ROM Catalog by completing the business reply card in the back of this catalog.

Mixed Signal Sources

Arbitrary Generators

Tektronix offers a wide variety of Arbitrary Waveform Generators that have the capabilities to earn the title of "Mixed Signal Source." From the powerful and easy to use 2000 Series Benchtop to fast system VXI sources, Tektronix has an Arbitrary signal source to solve your application requirements.

Arbitrary waveform generators ("Arbs" for short) are used to generate "real world" signals. They can generate signals with all the glitches, drift, noise, and other anomalies that a device under test will encounter when it leaves the lab or manufacturing floor. Arbs are being used for disk drive testing, automotive anti-lock brakes and engine control modules, fax testing, biomedical simulations and more.

"What if" scenarios are easy since waveforms can be captured from a digital scope and then modified to see when a device under test fails. They also make it easy to simulate transducers that can be difficult or expensive to use.

Arbitrary Waveform Generators have evolved from simple B/A converters to sophisticated signal sources with powerful creation, editing and triggering capabilities.

CONTENTS

General Information 579

MIXED SIGNAL SOURCES

ARBITRARY GENERATORS

AWG 2041 394
AWG 2021 396
AWG 2005 398

ARBITRARY WAVEFORM SOFTWARE

WaveWriter™ 391

LOGIC SOURCES

HFS 9003 401
HFS 9009 401
DG 2020 404

FUNCTION GENERATORS

CFG 253 413
CFG 280 413

Mixed Signal Sources

ARBITRARY WAVEFORM GENERATOR SELECTION GUIDE

	Tektronix AWG 2041	Tektronix AWG 2021	Tektronix AWG 2005
Maximum Clock Rate (Point Rate)	1 GS/s (1 ns/pt) (up to 10 ps timing resolution with Region shift)	250 MS/s (4 ns/pt) (up to 4 ps timing resolution with Region shift)	20 MS/s (50 ns/pt) (up to 50 ps timing resolution with Region Shift)
Output Channels	1	1 std.; 2 total opt.	2 std.; 4 total opt.
Ampl V p-p into 50 Ω	2 V p-p; 4 V p-p differential	5 V p-p	10 V p-p
Region Shift	10 ps	4 ps	50 ps
Vertical Resolution (bits)	8	12	12
Sine, Sqr, Tri, Ramp, DC	10 MHz Synthesized	2.5 MHz Synthesized	200 kHz Synthesized
Execution Memory	1 MB std. (4 MB Opt. 01)	256 KB/CH	64 KB/CH
Built-in Waveform Editing	Graphical, Equation. Digital Timing, Table, Autostep Sequencing, Enhanced Math	Graphical, Equation. Digital Timing, Table, Autostep Sequencing, Enhanced Math	Graphical, Equation. Digital Timing, Table, Autostep Sequencing, Enhanced Math
Direct DSO Transfer	Direct via GPIB	Yes	Yes
Parallel Digital Output	8-Bits ECL + 2 markers (Opt. 03)	12– or 24-Bit (TTL @ 100 MHz) 12-Bit (ECL @ 250 MHz) + 2 markers (Opt. 03 or 04)	24-Bit TTL + 2 markers (Opt. 04)
Software Support	WaveWriter™ LabVIEW	WaveWriter™ IQSIMK; LabVIEW	WaveWriter™ IQSIMK; LabVIEW
Where to find more info.	Page 394	Page 396	Page 398

Waveform Editing Software

WaveWriter™

Features

WaveWriter WAVEFORM CAPTURING AND EDITING SOFTWARE

- Create/Modify/Document Waveforms for DSOs and Arbitrary Generators
- Use WaveWriter Standalone or Integrated into Application Development Environments
- Create Waveforms by Freehand Drawing (or with Autolining Between Selected Points) by Editing Standard Functions, Writing Equations, or by DSO Acquisition.
- Edit Waveforms by Cut and Paste Methods; or Invert, Add, Subtract, Multiply, or Divide Whole Waveforms or Portions
- WaveWriter Automatically Scales Record Size, Resolution, Etc., to Single or Double Target Instruments
- Microsoft Windows-based User Interface
- Support GPIB or RS-232 Instruments
- Runtime Environment for Margin Testing

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

WaveWriter (AWE) Waveform Capturing and Editing Software

WAVEFORM GENERATION

WaveWriter is a software package for creating and modifying waveforms for the Tektronix Arbitrary Waveform Generators and Digital Oscilloscopes. WaveWriter software represents a major step forward in allowing easy creation of the real world signals which are increasingly being used to test circuit tolerances, drive vibration/shake tables, and simulate other non-ideal or corrupted signals.

WaveWriter software offers an easy to use alternative to general-purpose programming languages for waveform definition. Its user interface is based on Microsoft Windows, with pull-down menus and mouse-selected icons. (Alternatively, you can use a command-driven interface.) It can operate independently, or as an integral part of a system program.

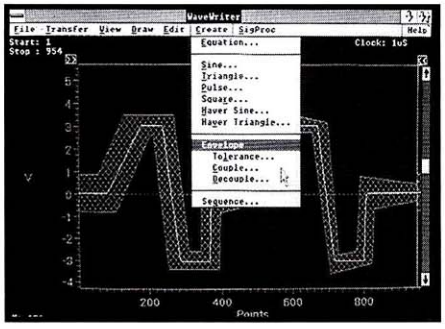
ACQUIRE OSCILLOSCOPE SIGNALS

Signals may be acquired from a variety of Tektronix TDS Series, DSA Series, 11000 Series, 2200 Series, 2400 Series digital oscilloscopes. The signals may then be modified, stored, or recreated with an arbitrary waveform generator.

CREATE CUSTOM WAVEFORMS

Define waveforms by:

- Entering equations, polynomial expressions, and limits
- Drawing them freehand
- Selecting endpoints of straight line segments
- Editing standard functions, including sines, square pulses, triangles, and haver functions
- Uploading captured functions from a suitable digital oscilloscope



Create the reference memory template waveform for pass/fail testing on 2400 Series Oscilloscopes.

EDIT WAVEFORMS GRAPHICALLY

By defining sections of a waveform with WaveWriter software markers (which work like the cursors on an oscilloscope display), you can perform mathematical functions, including inversion; scale vertically and horizontally; and cut and paste. For example, you can add harmonically related sinusoids to construct a signal from its Fourier components. Or, starting with a signal captured by an oscilloscope, you can add glitches and distortion to test a circuit's response to specific kinds of signal aberrations.

PASS/FAIL LIMIT TESTING

WaveWriter software also supports digital storage oscilloscopes with template generation for the Waveform Documentation. Therefore, with WaveWriter software, the user can create the exact tolerances of templates with which to capture a differentiated signal or automatically identify a failure. This is a great feature for margin test applications where fast test windows can be created in seconds.

WaveWriter software now offers three different techniques for recording waveform data, including *.ADF, *.ISF, and *.CSV. Comma Separated Variable (CSV) is an ASCII format which allows the user to quickly and easily incorporate the waveform data into spread sheets, word documents and other math processing software packages.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

S3FT400
Tektronix WaveWriter™ System Software.
WaveWriter™ is provided on 1.44 MB 3.5 in. diskettes.

Mixed Signal Sources
2000 SERIES

Features

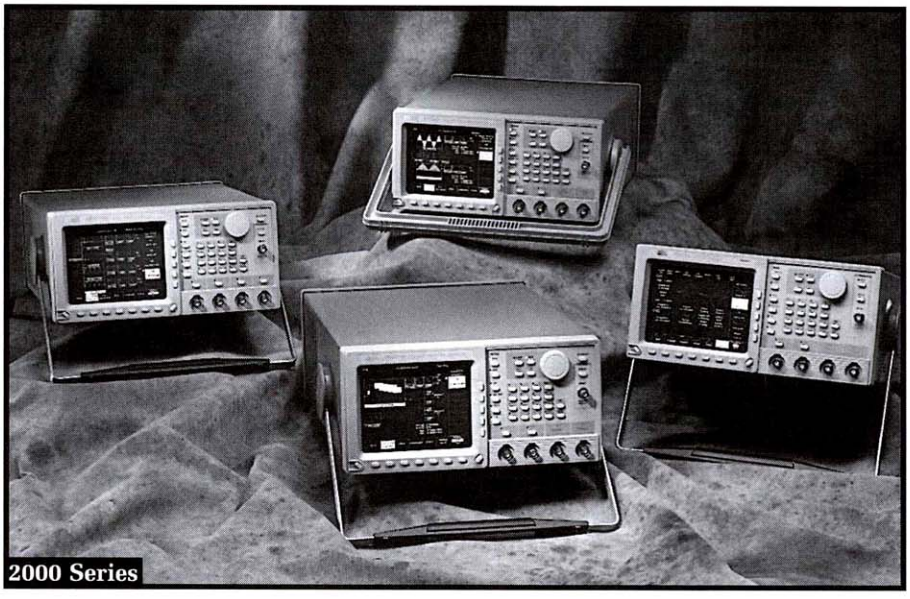
2000 SERIES APPLICATIONS

- Simulate Wireless
  - Broadband
  - I & Q
  - Universal Modulation Coder
  - Complex Modulation
  - Spread Spectrum
  - FSK, PSK, AM
  - Jitter Modulation
  - Mobile Communication
  - Digital Cellular
- Simulate Media
  - Disk Drive Read/Write
  - Peak Shift
  - Bit Drop Out
  - Servo Control
  - Mixed Signal ASICs
- Simulate Biomedical
  - Physiological Responses
  - Heart Fibrillation
  - Blood Gas Content
  - EEG and EKG
- Simulate Network Physical Layer
  - Token Ring
  - Ethernet
  - ATM
  - SONET
  - Fax and Modems
- Avionics Simulation
  - Flight Characterization Flight Data Recorders
  - Instrument Launching Navigation Systems (ILS/MLS/VOR)
- Automotive Simulation
  - Engine Control Modules
  - Ignition Systems
  - Mechanical Vibration Analysis
  - Anti-lock Braking
  - Safety Retraining Systems

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE


2000 Series

2000 Series Arb Overview

Standard function generators offer limited capability when compared to the robust capabilities offered in modern Arbitrary Generators. Today, in fact, we can consider the powerful 2000 Series Arbs as truly Mixed Signal Sources. In addition to the Arb's ability to replace conventional generators in applications, Arbs also provide other powerful capabilities.

For example, designers must test their products to operate under the actual conditions which their design will encounter in the "real world." However, real world test signals are often not ideal and may have undesirable components or impurities. These conditions may be observed as either repetitive or infrequent amplitude and/or frequency anomalies. Modern Arbitrary Generators are ideally suited to simulate all of the signal conditions encountered including both ideal and anomalies.

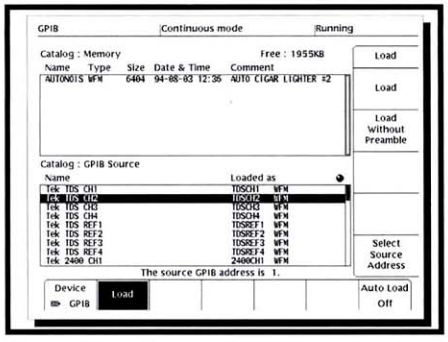
REGION SHIFT FUNCTION!
A function called Region Shift has been added to the 2000 Series AWGs. This capability provides an editing technique for simulating timing impairments for testing a design's response to a variety of frequency, timing or phase violations. This capability uniquely allows the 2000 Series AWGs to simulate shift phenomena with up to 2 orders of magnitude finer resolution than what was previously available with older Arb designs. Today, with the 2000 Series, up to 4 ps timing resolution is available! This powerful capability should hold significant appeal to most designers but especially to designers of magnetic media, physical layer, wireless and other products requiring jitter tolerance or timing shift testing.

REAL TIME SEQUENCE EDITOR
All 2000 Series AWGs uniquely support Real Time waveform sequencing capability. Older Arb designs offer a sequence or a loop compiler which limits the maximum effective output points to the maximum record length of the instrument.

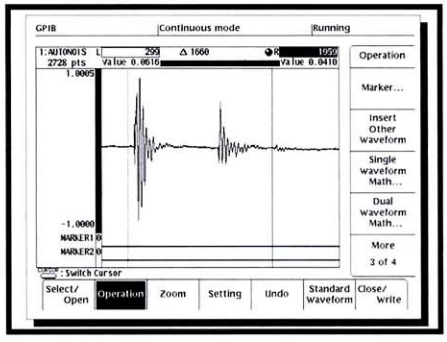
REAL TIME SEQUENCING
Sequencing extends the effective record length of the signal to over a billion points! Sequencing seamlessly transitions from one segment to the next with no discontinuities between segments. All segments in a sequence are executed from memory. Each segment can be repeated thousands of times with thousands of segments in a sequence. Using the Auto Step and Waveform Advance modes, users can modify the output of the arbitrary generator using an external event such as manual trigger, external trigger, GPIB, or RS-232.

Sequencer applications include serial or parallel pattern generation for digital test, building complex modulated signals such as FSK/PSK/PWM, magnetic media design/test, and filter design/test. The sequence editor is standard.

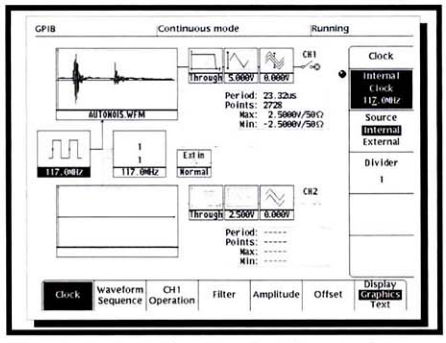
Mixed Signal Sources
2000 SERIES



Step 1: Transfer waveform from a digital scope.



Step 2: Modify waveform using one of several built-in editors (in this example, the graphical editor).



Step 3: Output the signal with complete control over its parameters.

FFT EDITOR - (OPTION 09)
The FFT editor allows easy modification of waveform frequency and phase components. Six different FFT windows available include Rectangle, Triangle, Hanning, Hamming, Blackman, and Blackman-Harris. The filter menu allows the user to view the impact of a user-definable filter network on a waveform. The built-in limiter function provides noise-floor editing to eliminate frequency components below a user-definable magnitude level. Some examples where FFT capability is used are filter and motor control applications.

DIGITAL TIMING AND TABLE EDITOR
The combination of the timing and table editor with the optional AWG data generator port is ideal for digital circuit testing and control of ASICs, DACs, etc. The AWGs can perform as parallel Pattern Generators with data rates up to their full clock speed. The table editor allows the user to edit the signals in binary, hex, or decimal. The timing editor provides a "logic analyzer" style timing diagram for easy manipulation of digital data. The timing and table editor is standard.

EQUATION EDITOR
The equation editor creates waveforms based upon polynomial formulas. This gives the user excellent flexibility to create waveforms based upon standard equations and to vary them easily by changing the formula. Examples of waveforms that can be created with the equation editor include 1F read head signals, SINX/X, damped sine waves, and exponential pulses. The equation editor is standard.

The built-in editors make creation of FSK, PSK, AM, FM or Offset modulated signals easy. For example, to create a 4-key FSK signal, simply enter the frequencies and amplitudes of each key using a straightforward entry screen. The modulation in the frequency domain is standard on the AFG 2020.

SWEEP EDITOR
The sweep editor allows generating linear logarithmic or user-definable sweeps by using a simple graphical editor. You see the effects of changing the parameters as you edit them. The sweep editor is an option on the AWG 2005.

Common 2000 Series Characteristics

ENVIRONMENTAL

Temperature – Operating: +10°C to +40°C. Nonoperating: –20°C to +60°C.

Temperature Change – Operating: +15°C per hour (no condensation). Nonoperating: +30°C per hour (no condensation).

Humidity – Operating: 20% to 80% (no condensation). Nonoperating: 5% to 90% (no condensation).

Altitude – Operating: To 4.5 km (15,000 ft.). Maximum operating temperature decreases 1°C for each 300 m above 1.5 km. Nonoperating: To 15 km (50,000 ft.).

Vibration – Operating: 0.33 mm p–p, 10 Hz to 55 Hz for 15 minutes.

Shock – Nonoperating: 30 g (1/2 sine) 11 ms duration.

Bench Handling – Operating: Drop from 10 cm (4 in.) tilt or 45°, whichever is less.

EMC – Emissions: Within limits of FCC CFR 47, Part 15, Subpart B, Class A; VFG 243; EN55022, B; EN6055-2. Immunity: Within limits of IEC 801-3, IEC 801-2, IEC 801-4.

Electrical Discharge – Operating max test voltage: 15 kV (150 pF through 150 Ω).

Safety – Designed to meet UL 1244 and CSA 22.2 No. 231. EEC certified.

POWER

Source Power – Voltage Ranges: 90 to 127 V AC or 90 to 250 V AC. Line Frequency: 90 to 127 V, 48 to 440 Hz; 90 to 250 V, 48 to 63 Hz.

Maximum Current – 4 A at 50 Hz, 90 V.

Maximum Power Dissipation – 300 W.

Fuse Rating – UL 198.6 (3AG): 6 AFAST, 250 V. IEC 127:5 A (T), 250 V.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height (with feet)	164	6.4
Width (with handle)	362	14.3
Length (with front cover)	491	19.25
Length (with handle extended)	576	22.2
Weight	**kg**	**lbs.**
Net	10.7	23.6

1 GS/sec Arbitrary Waveform Generator

AWG 2041

Features

AWG 2041

- 1.024 GS/sec Clock Rate Provides up to 500 MHz Waveforms
- 1 MB Record Length (4 MB with Opt. 01)
- Region Shift Function Provides 10 ps Edge Placement
- 8-Bit (1/256) Vertical Resolution
- Direct DSO Waveform Transfers
- Optional 8-Bit 1 GHz Digital Data Generator
- Built-in 1.4 MB 3.5 in. Floppy Disk
- FFT Editor (Option 09) – Frequency Domain Editing
- Real Time Waveform Sequencer Creates Automatic Test Sequences or Extremely Long Patterns Almost Infinitely
- Formula Entry of Waveforms
- Fully Programmable from Front Panel, RS-232, or GPIB (IEEE 488.2)
- CE Certified

Applications

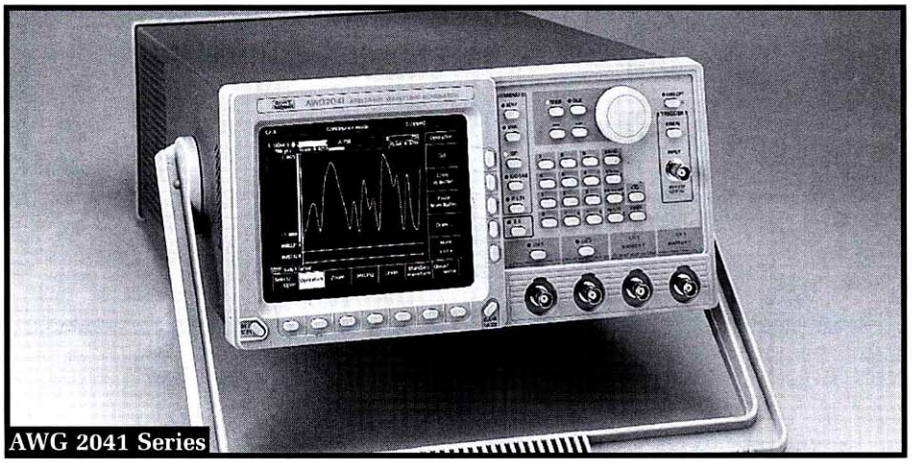
- Video
- Network
- Physical Layer Test
- Navigation
- Radar
- Computer Peripherals
- Data Storage
- Electronic Warfare Simulation
- Converter Testing
- Filter Design
- Semiconductor/Logic (ASIC/DAC/FPGA)
- CCD
- LCD (STN/TFT/MIM)

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE


AWG 2041 Series

AWG 2041 Series Arbitrary Waveform Generator

The AWG 2041 is the world's fastest and deepest memory Arbitrary Generator with its 1 GS/s sample rate and 1 MB execution memory (4 MB, Option 01). As with the entire 2000 Series family, the graphical user interface allows on-screen viewing of waveform editing and simplifies "what-if" test scenarios by easily allowing the creation of composite signals.

The standard AWG 2041 configuration provides up to 2 V output or 4 V with the complementary output, each with 8-Bits vertical resolution. Option 03 adds a 8-Bit-wide ECL digital data port which can be used in conjunction with the marker outputs for data generation up to 10-Bits wide at up to 1 GHz. The AWG 2041 supports true Real Time Sequencing capability similar to the AWG 2021.

The Real Time waveform sequencer extends the effective record length output to over a billion points! The built-in frequency domain (FFT) editor (Option 09) is a perfect addition for customers performing modulation simulations, filter design or testing physical layer jitter tolerance, or for pulse mask testing.

The AWG 2041 easily simulates signals where fine point definition and long records are required for simulating very complex waveform conditions. Direct waveform transfer capability makes the AWG 2041 the perfect accessory for Tektronix DSOs.

Characteristics

STANDARD WAVESHAPES
Sine, square, triangle, ramp, pulse, arbitrary, linked sequence, and DC.

ARBITRARY WAVEFORMS
Execution Memory – Waveform: 1 Mwords (4 Mwords with Option 01). Marker: (2) 1 Mwords (4 Mwords x 2-Bits with Option 01). Waveform size: 32 points to 1 M (4 M with Option 01) in multiples of 32.

Real Time Sequencer Memory – 8 K individual waveforms.

Loop Counter –
Waveform: 1 to 64 K
Sequence: 1 to 64 K repeats.

CATALOG MEMORY CLOCK
Frequency Range – 1.000000 kHz to 1.024000 GHz.

Resolution – 7 digits.

Stability – 1 ppm/year (+15°C to ±25°C).

OPERATING MODES
Continuous – Output waveform/sequence continuous at programmed waveshape, frequency, amplitude, and offset.

Triggered – Output quiescent until triggered by an external, GPIB, or manual trigger; generates a waveform/sequence only one time.

Burst – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates a waveform/sequence up to 65,536 times.

Gated – Same as continuous mode except period is executed only for the duration of the gated signal until the sequence started is completed.

Waveform Advance – Output quiescent until triggered by an external, GPIB, or manual trigger, then generates the waveform/sequence in the Sequence file. When the scan count reaches value, output stops and waits for next trigger.

1 GS/sec Arbitrary Waveform Generator

AWG 2041

Auto Step – Continuously outputs the waveform/sequence in the Auto Step file; the next Auto Step Trigger (rear panel) advances the waveform/sequence.

Slave – Receives clock from a master arbitrary waveform generator for parallel operation.

MAIN OUTPUTS – CH 1 & COMPLIMENT
Digital-to-Analog Converter Resolution – 8-Bits.

Output Impedance – 50 Ω.

Output Voltage – –2.0 V to +2.0 V into 50 Ω (L/V differential).

Amplitude – Range: 20 mV to 2 V into 50 Ω. Resolution: 1 mV.

Offset – Range: –1.000 V to 1.000 V into 50 Ω. Resolution: 1 mV. Accuracy (20 mV Amplitude, 7F waveform data): ±(1% of offset + 5 mV).

Rise Time – Amplitude >1.0 V, ≤2.5 ns; Amplitude ≤1.0 V, ≤1.5 ns.

Fall Time – Amplitude >1.0 V, ≤2.5 ns; Amplitude ≤1.0 V, ≤1.7 ns.

Aberrations (at full BW) – Amplitude >1.0 V, within ±10%; Amplitude ≤1.0 V, within ±7%.

Flatness – Within ±3% after 50 ns from rise/fall edges.

Sinewave Characteristics (1 GHz clock, 32 waveform points, 31.25 MHz frequency, 1.0 V amplitude, no offset, no filter) –
Harmonics: ≤45 dBc, DC to 400 MHz.
Noise: ≤50 dBc, DC to 400 MHz.
Phase Noise: –90 dBc/Hz at 10 kHz offset.

FILTERS
Type – Bessel low pass.

Risetime – 10 MHz: 35 ns, 20 MHz: 17 ns. 50 MHz: 7.0 ns. 100 MHz: 3.5 ns.

Delay from Marker – 10 MHz: 42 ns. 20 MHz: 22 ns. 50 MHz: 12 ns. 100 MHz: 7.0 ns. Through: 2.5 ns.

AUXILIARY OUTPUTS
Marker – Number of Markers: 2. Level: Hi/Lo, –2.0 V to 2.0 V into 50 Ω, –4.0 V to 4.0 V into 1 MΩ; Resolution, 0.1 V Accuracy: within ±0.1 V. Rise/Fall Time: <1 ns (at 1 V p-p). Connector: BNC.

Busy – Level: Positive TTL pulse (0 V to 5.0 V into 1 MΩ). Delay: <60 ns from Ext. Trig; <150 ns from CH 1. Output Resistance: 51 Ω. Connector: SMB.

Sync – Level: Positive TTL pulse (0 V to 5.0 V into 1 MΩ). Delay: <60 ns from Ext. Trig. Duration: 100 ns. Output Resistance: 51 Ω. Connector: SMB.

Master Clock – Level: ECL compatible (–1.620 to –0.810 into 50 Ω). Connector: SMB.

8-Bit ECL Digital Out (Option 03) –
Output Signals: D0 to D7, Clock.
Level: ECL compatible (–1.81 V to –0.810 V into 50 Ω). Skew Between Data: ±250 ps. Delay: Data to Marker: 2.0 ns; Clock to Data: 2.5 ns. Connector: SMB.

AUXILIARY INPUTS
Trigger – Threshold: Level, –5 V to +5 V; Resolution: 0.1 V; Accuracy: –(5% x Level + 0.1 V). Pulse Width: 10 ns minimum (0.2 V amplitude). Sensitivity: 0.2 V minimum (1 MHz square wave). Maximum Input: ±10 V p-p when 1 kΩ selected; ±5 V when 50 Ω selected. Impedance: 1 kΩ or 50 Ω. Trigger Holdoff: 500 ns maximum.

Stop Trig – Threshold Level: TTL Level. Pulse Width: 100 ns minimum. Maximum Input Volts: +5 V to 0 V. Delay: 100 ms maximum. Impedance: 10 kΩ. Connector: SMB.

Auto Step Trig – Threshold Level: TTL Level. Pulse Width: 100 ns minimum. Maximum Input Volts: +5 V to 0 V. Delay: 100 ms maximum. Impedance: 10 kΩ. Connector: SMB.

External Clock – Sensitivity: 400 mV p-p (–4.0 dBm). Maximum Input Volts: 1.0 V p-p (+4.0 dBm) DC ±20 V. Frequency: 10 MHz to 1.0 GHz. Delay External Clock to Marker: 13 ns.

Slave Clock – Threshold: ECL compatible (100 K). Maximum Input Volts: –2.0 V to 0.0 V. Frequency: 650 MHz to 1.0 GHz. Delay External Clock to Marker: 13 ns.

FUNCTION GENERATOR
Waveform Shape (predefined 100-point waveforms) – Sine, Triangle, Square, Ramp, Pulse (50 MHz filter is inserted when Sine is selected). Frequency: 1.000000 Hz to 10.00000 MHz. Accuracy: 1 ppm. Amplitude: 20 mV to 2 V into 50 Ω. Offset: –1.000 V to 1.000 V into 50 Ω. Polarity: Normal, Invert. Duty Cycle: 0% to 100%, Pulse only. Sine Flatness: Within –1 dB referenced to 100 kHz.

PROGRAMMABLE INTERFACE
GPIB – IEEE 488.2-1987 compatible.

RS-232 – 9-Pin D connector.

See page 393 for Environmental Characteristics.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

AWG 2041
1 GS/s Arbitrary Waveform Generator.
Includes: User/Programmer's Manual 070-8657-04, GPIB Programming Examples Disk, Cal. Certificate, Sample Waveform Library Disk, Power Cable.

Opt. 01 – Increase Memory to 4 M words.

Opt. 03 – ECL Digital Data Output.

Opt. 09 – Add FFT Editor. Allows Editing Waveforms in the Frequency Domain.

Opt. 1R – Rackmount. Floppy Drive Access Moved to Front.

Opt. 1S – Adds WaveWriter™ Software.

Opt. B1 – Service Manual.

Opt. 95 – Cal Data Report.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5.

ACCESSORIES
Accessory Pouch – Order 016-1159-00.

Front Cover – Order 200-3232-01.

RS-232-C Cable – 9-Pin to 25-Pin. Order 174-1453-00.

Service Manual – Order 070-8963-00.

GPIB Cable – Order 012-0991-00.

SMB to BNC Cable – Order 012-1459-00.

SMB to BNC Adapter – Order 015-0554-00.

SMB Cable – Order 012-1342-00.

UPGRADE KITS
4 MB Memory – Order 040-1446-00.

FFT – Order 040-1445-00.

Rackmount Kit – Order 040-1444-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

250 MS/sec Arbitrary Waveform Generator

AWG 2021

Features

AWG 2021

- 250 MS/s Clock Rate Provides up to 125 MHz Waveforms
- 256 K (262,144 Points) Record Length
- 12-Bit (1/4096) Vertical Resolution
- Direct DSO Waveform Transfers
- Region Shift Function Provides 4 ps Edge Placement
- Optional 12-Bit 250 MHz (ECL) or 12/24-Bit 100 MHz (TTL) Digital Data Generator
- Built-in 1.4 MB 3.5 in. Floppy Disk
- FFT Editor (Opt. 09) Frequency Domain Editing
- Real Time Waveform Sequencer
  – Easily Create Automatic Test Sequences or Extremely Long Patterns
- Formula Entry of Waveforms
- Fully Programmable from Front Panel, RS–232, or GPIB (IEEE 488.2)
- CE Self-certified

Applications

- Analog & Digital Modulation
- Wireless Communication
- All Forms of Fading Simulation
- Navigation
- I & Q Impairment
- Audio
- Computer Peripherals
- Automotive
- Converter Testing
- Filter Design
- Semiconductor Logic (ASIC/DAC/FPGA)
- CCD
- LCD

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

AWG 2021

AWG 2021 Arbitrary Generator

The AWG 2021 is our median performance product offering fast (250 MS/s) and deep memory (256K). As with the entire 2000 Series family, the graphical user interface allows on-screen viewing of waveform editing and simplifies "what if" test scenarios by easily allowing the creation of composite signals.

The standard AWG 2021 configuration provides one 5 V output or a second independent 5V output (Option 02) each with 12-Bits vertical resolution. Frequency of channel 2 is also independently programmable. Option 03 adds a 12-Bit-wide differential ECL digital port which can be used in conjunction with the marker outputs for data generation up to 14-Bits-wide at up to 250 MHz. Or if you prefer, Option 04 provides TTL digital levels with up to (2) 12-Bit, 100 MS/s ports for a total of 28-Bits wide.

The built-in frequency domain (FFT) editor (Option 09) is a perfect addition for customers performing proprietary or standard modulation simulations, filter design or in testing physical layer. Real time waveform sequencing extends the effective record length output to over a billion points!

The AWG 2021 easily simulates signals where moderate point definition and long records are required for simulating very complex waveform conditions. Direct waveform transfer capability makes the AWG 2021 the perfect accessory for Tektronix DSOs.

Characteristics

STANDARD WAVESHAPES
Sine, square, triangle, ramp, pulse, arbitrary, linked sequence, and DC.

ARBITRARY WAVEFORMS
Execution Memory – Waveform: 256 Kwords. Marker: 256 Kwords x 2-Bits. Data Points of Waveform Size: 64 to 256 K in multiples of 8.

Real Time Sequencer Memory –
8 K individual waveforms.
Loop Counter: 1 to 65,535 repeats.
Burst Mode Counter: 1 to 64 K cycles.

CATALOG MEMORY CLOCK
Frequency Range – 10 Hz to 250 MHz.

Resolution – 4 digit.

Accuracy – 50 ppm (+15°C to +30°C).

Skew between CH 1 and CH 2 (Option 02 only) – Within 4 ns.

OPERATING MODES
Continuous – Output continuous at programmed waveshape, frequency, amplitude, and offset.

Triggered – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates a sequence only one time.

Gated – Same as triggered mode except period is executed only for the duration of the gated signal until the sequence started is completed.

Burst – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates "n" sequences or cycles.

250 MS/sec Arbitrary Waveform Generator

AWG 2021

Waveform Advance – Continuously generates the waveform in a predefined sequence; the next trigger advances to the next waveform in sequence.

Autostep – Generates the predefined waveform once in the Autostep File; the next trigger advances the waveform.

MAIN OUTPUT

Amplitude (excluding ADD and Multiply operation) – Digital-to-Analog Resolution: 1/4096 (12-Bits). Range: 0.05 V to 5 V p-p into 50 Ω. DC Accuracy: 0.05 V to 0.5 V, ±(0.5% of amplitude +5 mV); 0.501 V to 5 V, ±(1% of amplitude +25 mV).

Offset – Range: –2.5 V to +2.5 V into 50 Ω, (–100 mA to +100 mA). Resolution: 0.2 mA. Accuracy: ±(1% of offset +0.2 mA).

Pulse Response – +15°C to +30°C: Flatness, within 3% after 20 ns from rise/fall edges; Aberrations, within 7% +10 mV. +10°C to +40°C: Rise/Fall Time, <4.2 ns; Flatness, within 5% after 20 ns from rise/fall edges; Aberrations, within 9% +10 mV.

Impedance – Typically 50 Ω.

Sinewave (amplitude 1 V, 100 kHz reference) – Flatness: Within 4%. THD: 1.0 V, ≤50 dBc, 0.5 V, ≤66 dBc; Spurious: ≤66 dBc.

CHANNEL SUMMING (Option 02 only)

AM (Multiply) – Output: Within 5%. Frequency Response: DC to 30 MHz.

External AM – Sensitivity: 2 V p-p (±5%) signal produces 100% modulation. Frequency Response: CH 1, DC to 30 MHz; Ext. Signal, DC to 4 MHz.

Add – Output: Within 5%. Frequency Response: DC to 30 MHz.

FILTERS

3 dB Cutoff Frequency – 1 MHz: Within 20%. 5 MHz: Within 20%. 20 MHz: Within 20%. 50 MHz: Within 20%.

Delay – 1 MHz: Typically 390 ns. 5 MHz: Typically 78 ns. 20 MHz: Typically 18 ns. 50 MHz: Typically 11 ns.

AUXILIARY OUTPUTS

Markers 1 and 2 – Amplitude: 1 V ±0.3 V into 50 Ω. Impedance: 50 Ω. Marker to Signal Delay: Within 15 ns.

Sync – Amplitude: 1 V ±0.3 V into 50 Ω. Impedance: 50 Ω. Sync to Signal Delay: Within 15 ns.

Clock – Amplitude: 1 V ±0.3 V into 50 Ω. Impedance: 50 Ω.

Digital Data Out (Option 03) – Level: Differential ECL compatible. Output Signals: Data (D0 to D11). Skew Between Data: Within 1 ns. Clock to Data Delay: Within 3 ns. Connector: 68-Pin mini-D sub.

AUXILIARY INPUTS

Trigger – Threshold Level: –5 V to +5 V. Resolution: 0.1 V. Accuracy: ±(5% x Level + 0.1 V). Pulse Width: 15 ns minimum. Input Swing: 0.2 V minimum. Maximum Input Volts: 10 V p-p when 1 MΩ selected; 5 V RMS when 50 Ω selected. Impedance: 1 MΩ with 30 pF max. Trigger to Output Signal Delay: External Clock, 100 ns maximum +1 clock.

Trigger Holdoff – 5 µs maximum.

AM (Option 02 only) – Range: 2 V p-p (–1 V to +1 V) for 100% modulation. Maximum Input: ±5 V p-p, 10 kΩ impedance.

System Clock – Threshold Level: 0.3 V ±0.1 V. Input Swing: 0.8 V minimum. Pulse Width: 2 ns minimum. Maximum Input Voltage: ±2 V p-p. Impedance: 50 Ω. Frequency Range: Up to 250 MHz phase coherent.

PROGRAMMABLE INTERFACE

GPIB – IEEE 488.2-1987 compatible.

RS-232 – 9-Pin D connector.

See page 393 for Environmental Characteristics.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

AWG 2021
250 MS/s Arbitrary Waveform Generator. Includes: User/Programmer's Manual 070-9097-01/070-8657-04, GPIB Programming Examples Disk, Sample Waveform Library Disk, Cal. Certificate, Power Cable.

Opt. 02 – Independent, 256 K Second Channel.

Opt. 03*1 – 12-Bit, ECL Digital Data Out.

Opt. 04*1 *2 – 12/24-Bit, TTL Digital Data Out.

Opt. 09*1 – Add FFT Editor. Allows editing waveforms in the frequency domain.

Opt. 1R – Rackmount. Floppy moved to front.

Opt. 1S – Adds WaveWriter™ Software.

Opt. 95 – Cal DAT Report.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Mixed Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

ACCESSORIES

Accessory Pouch – Order 016-1159-00.

Front Cover – Order 200-3232-01.

RS-232-C Cable – 9-Pin to 25-Pin. Order 174-1453-00.

Rackmount Kit – Order 040-1444-00.

12-Bit Digital Cable (Opt. 04) – Order 174-3192-00.

12-Bit ECL 174 (Opt. 03) – Digital Cable.

GPIB Cable – Order 012-0991-00.

**1 Options 03, 04, and 09 are mutually exclusive.*

**2 12-Bits with single channel, 24-Bits with dual channel (Opt. 02).*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

20 MS/sec Arbitrary Waveform Generator

AWG 2005

Features

AWG 2005

- 20 MS/s (50 ns) Clock Rate Provides up to 10 MHz Waveforms
- Up to Four Channels of 64 K Record Length
- 12-Bit (1/4096) Vertical Resolution
- Direct DSO Waveform Transfers
- Region Shift Provides 50 ps Edge Placement
- 24-Bit Channel, TTL Digital Data Generator (Opt. 04)
- Linear Log and User Definable Sweep Generation (Opt. 05)
- Built-in 1.4 MB 3.5 in. Floppy Disk
- FFT Editor (Opt. 09) Frequency Domain Editing
- Real Time Waveform Sequencer
  - Easily Create Automatic Test Sequences of Extremely Long Patterns
- Formula Entry Waveforms
- Fully Programmable from Front Panel, RS-232, or GPIB (IEEE 488.2)
- CE Self-certified

Applications

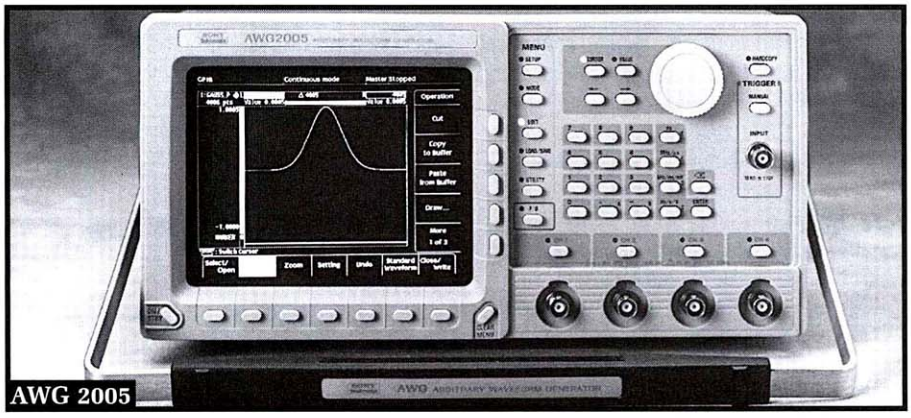
- Analog & Digital Modulation
- Digital Baseband Modulation
- Sonar Testing
- Transducer Simulation
- Motor Control
- Automotive
- Industrial
- Sensors
- Semiconductor/Logic

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE



AWG 2005 Arbitrary Waveform Generator

The AWG 2005 is our best value product and offers 20 MS/s and 64 K deep memory. As with the entire 2000 Series family, the graphical user interface allows on-screen viewing of waveform editing and simplifies "what if" test scenarios by easily allowing the creation of composite signals.

The standard AWG 2005 configuration provides two independent 10 V outputs or a third and fourth 10 V output (Option 02) each with 12-Bits vertical resolution. Option 04 adds TTL digital levels with (2) 12-Bit, 100 MS/s ports and combines with the marker outputs to provide a total of 28-Bits wide.

The built-in sweep generator provides even more flexibility by offering linear and logarithmic swept frequencies, but even more significantly the AWG 2005 has user definable sweep capability. This allows creation of digitally modulated signals at IF frequencies.

The built-in frequency domain (FFT) editor (Option 09) is a perfect addition for customers performing proprietary or standard I & Q modulation simulations, filter design or in circuit testing of physical layer. Real time waveform sequencing extends the effective record length output to over a billion points!

The AWG 2005 easily simulates signals where moderate point definition and long records are required for simulating complex waveform conditions. Direct waveform transfer capability makes the AWG 2005 the perfect accessory for Tektronix DSOs.

Characteristics

STANDARD WAVESHAPES
Sine, square, triangle, ramp, noise, arbitrary, linked sequence, and DC.

ARBITRARY WAVEFORMS
Execution Memory – Waveform: 64 K (65,535) for each channel. Marker: 64 K for each channel. Waveform Size: 16 to 64 K in multiples of 16.

Real Time Sequence Memory – 8 K individual waveforms.

Loop Counter – Waveform: 1 to 64 K repeats. Sequence: 1 to 64 K repeats.

Catalog Memory – 2 MB.

CATALOG MEMORY CLOCK
Frequency Range – 0.01 Hz to 20 MHz.

Resolution – Standard: 4 digits. With Option 05: 7 digits.

Accuracy – Standard: 50 ppm (+15°C to +30°C). Option 05: 5ppm (+15°C to +30°C).

OPERATING MODES
Continuous – Output waveform/sequence continuous at programmed parameters.

Triggered – Output quiescent until triggered by an external, GPIB, or manual trigger; generates a waveform/sequence only one time.

Gated – Same as continuous mode except period is executed only for the duration of the gated signal until the sequence is completed.

Seq/Wfm Advance – Continuous: Continuously outputs the waveform/sequence in the Sequence file. The next trigger advances to the next waveform/sequence. Step: Output quiescent until triggered; then execute the next waveform/sequence in the Sequence file. When the loop count reaches its value, output stops and waits for next trigger.

Auto Step – Continuous: Continuously outputs the waveform/sequence in the Auto Step file. Step: Output quiescent until triggered.

20 MS/sec Arbitrary Waveform Generator

AWG 2005

Master – Provides Point Rate Clock and Trigger to a slave arbitrary waveform generator for phase synchronous parallel operation.

Slave – Receives Clock and Trigger from a system clock for parallel operation.

MAIN OUTPUT

Digital-to-Analog Resolution – 12-Bits.

Output Impedance – 50 Ω.

Amplitude (1 MHz clock, 000 and FFF waveform data, norm, no filter, no offset, excluding and ADD operation) – Range: 0.05 V to 10 V p-p into 50 Ω. Resolution: 1 mV (4 digits). DC Accuracy: 0.050 V to 0.999 V, ±(0.5% of amplitude + 5 mV); 1.000 V to 10.000 V, ±(1% of amplitude + 50 mV).

Offset – Range: –5.0 V to +5.0 V into 50 Ω (–200 mA to +200 mA). Resolution: 5 mV (4 digits). Accuracy (1 MHz clock, 7FF waveform data, norm, no filter, amplitude range 0.05 V): –±(1% of offset + 10 mV).

Pulse Response (20 MHz clock, 000 and FFF waveform data, norm, no filter, amplitude 5 V, no offset) – Rise/Fall Time: <35 ns. Flatness: Within ±3% after 150 ns from rise/fall edges. Aberrations: Within ±7%.

Cross Talk Between Channels – 512-point sine, 20 MHz clock, norm, no filter, amplitude offset. <70 dBc.

Noise Floor – 20 MHz clock, 7FFF waveform data, norm, no filter, no offset. 0.5 V: ≤110 dBm/Hz at 1 MHz. 5.0 V: ≤95 dBm/Hz at 1 MHz.

Sinewave Characteristics – Function Generator mode, 100 Hz to 200 kHz, no offset. Flatness (1 V amplitude, 1 kHz reference): Within –4%. T.H.D. (Including up to 4th harmonics): ≤55 dBc at 5.0 V.

AUXILIARY OUTPUTS

Marker – Amplitude: >2 V into 50 Ω. Impedance: 50 Ω. Marker to Signal Delay: 35 ns.

Clock – Amplitude: >2 V into 50 Ω. Impedance: 50 Ω.

Control Sig. – Amplitude: >2 V into 50 Ω. Impedance: 50 Ω.

Sweep (Option 05) – Waveshape: Same waveshape as selected sweep. Amplitude: 0 to 5 V (amplitude is dependent upon start and stop frequencies with a 5 V maximum limit). Impedance: 600 Ω.

24-Bit TTL Digital Data Out (Option 04) – Output Signals (CH 1 and CH 2): D0 to D11, Clock. Level: TTL. Amplitude: >2 V into 50 Ω. Skew Between Data: Within ±10 ns. Clock to Data Delay: Within ±10 ns. Impedance: 50 Ω.

AUXILIARY INPUTS

Trigger – Threshold Level: –5 V to +5 V. Resolution: 0.1 V. Accuracy: ±(5% of Level + 0.1 V). Minimum Pulse Width: 150 ns. Minimum Input Swing: 0.2 V p-p. Maximum Input Volts: ±10 V (DC + peak AC). Impedance: 10 kΩ. Trigger to Signal Delay: Internal Clock, 400 ns (excluding clock sweep mode).

AM (512-point sine, 20 MHz clock, AM, no filter, 5 V amplitude, no offset) – Range: 2 V p-p (–1 V to +1 V) for 100% modulation. Amplitude Accuracy: Within 5%. Maximum Input Volts: –5 V (DC + peak AC). Impedance: 10 kΩ.

ADD (512-point sine, 20 MHz clock, ADD, no filter, 5 V amplitude, no offset) – Range: 10 V p-p (–5 V to +5 V). Amplitude Accuracy: Amplitude specification plus 5%. Maximum Input Volts: –5 V (DC + peak AC). Impedance: 50 Ω.

Control Sig. – Threshold Level: TTL level (0.8 V to 2.0 V). Minimum Pulse Width: 40 ns. Maximum Input Volts: 5 V to 0 V. Impedance: 10 kΩ.

Clock – Threshold Level: TTL level (0.8 V to 2.0 V). Minimum Pulse Width: 20 ns. Maximum Input Volts: 5 V to 0 V. Impedance: External Clock, 330 Ω; Slave Mode, 10 kΩ. Frequency Range: 1 Hz to 20 MHz.

Sweep (Option 05 only) – Type: Linear, log, arbitrary. Mode: Continuous, triggered, gated. Update Rate: 1 s to 65,535 ms. Points per Sweep: 8 K maximum.

FUNCTION GENERATOR

Waveform Shape – (Predefined 100 pt. waveforms). Sine, Triangle, Square, Ramp, Pulse (1 MHz filter is inserted when Sine is selected).

Frequency – 1.000 Hz to 200 kHz.

Duty Cycle – 0% to 100%, Pulse only.

PROGRAMMABLE INTERFACE

GPIB – IEEE 488.2-1987 compatible.

RS-232 – 9-Pin D connector.

See page 393 for Environmental Characteristics.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

AWG 2005
Programmable Arbitrary Waveform Generator.
Includes: User/Programmer's Manual 070-8958-00/070-8657-03, GPIB Programming Examples Disk, Sample Waveform Library Disk, Cal. Certificate, Power Cable.

Opt. 02 – Add Two Channels (Four Total).
Opt. 04 – 24-Bit, TTL Digital Data Out*[1].
Opt. 05 – Add Clock Sweep.
Opt. 09 – Add FFT Editor.
Allows editing waveforms in the frequency domain*[1].
Opt. 1R – Rackmount. Floppy Drive Access Moved to Front.
Opt. 1S – Adds WaveWriter™ Software.
Opt. B1 – Service Manual.
Opt. 95 – Cal Data Report.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5.

ACCESSORIES
Accessory Pouch – Order 016-1159-00.
Front Cover – Order 200-3232-01.
RS-232-C Cable – 9-Pin to 25-Pin. Order 174-1453-00.
Service Manual – Order 070-8958-00.
Rackmount Kit – Order 040-1444-00.
GPIB Cable – Order 012-0991-00.
50 Ω BNC Cable – Order 012-1342-00.
12–Bit Word Generator Cable (Opt. 04) – Order 174-3192-00.
SMA to BNC Adapter – Order 015-0554-00.
50 Ω Termination – Order 011-0049-01.

[1] Opt. 04 and 09 are mutually exclusive.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

Logic Sources

CONTENTS

HFS 9003 401
HFS 9009 401
DG2020 404

Logic Sources

The concept of "real-world" signals has often been associated with Arbitrary Generators; however, digital applications also have a need to simulate both ideal and "real-world" conditions. For this reason, Tektronix offers a variety of Logic Sources. Each of these products is designed to provide digital signals with precise edge placement and amplitudes to meet a variety of digital stimulus needs.

HFS SERIES STIMULUS SYSTEM

These instruments offer the features of a high performance pulse generator and offer data generation capabilities as well. It is based on a Tektronix modular architecture which makes it easy to configure and maintain a digital stimulus system. This instrument supplants the need for switching matrices and DC power supplies. Logic levels are available directly at the outputs with no need for Auxiliary Pods. These programmable instruments allow more flexibility in pulse edge placement and control, including duty, period, repetition rate, and transition times. In addition, each channel has powerful independent skew control capabilities. This makes the HFS ideal for precise high performance characterization and evaluation applications.

DG2020 PORTABLE DATA GENERATOR

If you are a hardware design engineer performing functional test, debug, or characterization on digital subsystems, circuit boards or components, you need the DG2020. The DG2020 (200 MBPS, up to 36 channels, 65 KW data) can help you perform any of the following four tests with more performance and flexibility than you currently have.

- Replicate digital patterns created in a simulation program to verify a prototype operates as designed
- Replicate digital signals from a part of the system that isn't working yet or is too expensive to use as a data source
- Inject faults into a device under test to verify how the device will recover to those faults
- Characterize a device to determine the margins in timing and amplitude so that the device will operate correctly.

TEKTRONIX

	HFS 9DG2 Data Time Generator	HFS 9DG2 Data Time Generator	DG2020
Package Style	HFS 9000 Module	HFS 9000 Module	Portable
Max. Data Rate	350 MBPS	630 MBPS	200 MBPS
Period	2.8 ns~20 µs	1.6 ns~20 µs	5 ns
Resolution	–	–	4 digits
Output Channels	4/Module (max: 36)	4/Module (max: 36)	12/24/36
Pattern Depth	64 K	64 K	64 K
Looping	No	No	Yes 5 kstep/ 256 block
Ext. Jump	No	No	Yes
Output(V)(Open)	max: 3.00 V_{p-p}	max: 5.50 V_{p-p}	max: 9.0 V_{p-p}
Tr/Tf	<250 ps	800 ps~6 ns	P3410 (<5 ns) P3420 (<4 ns @ 5 V_{p-p})
Output Connector	SMA	SMA	P3410 (Header), P3420 (SMB)
Timing Control	Full	Full	4/8/12
Resolution	1 ps	1 ps	100 ps

Programmable Stimulus System

HFS 9003 • HFS 9009 • HFS 9DG1 • HFS 9DG2

Features

HFS 9000 SERIES

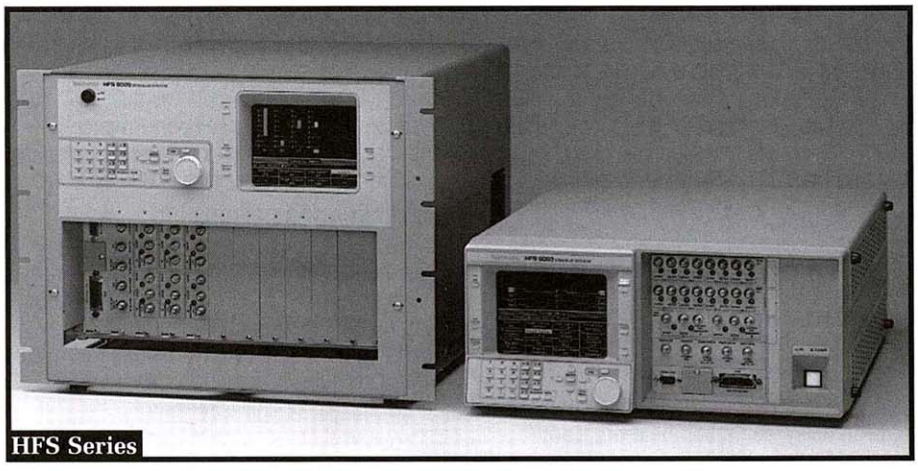
- Complete Stimulus Setup in Just Minutes
- Specify Data and Timing on Every Pin
- Up to 630 MHz Repetition Rate
- Fully Digital Implementation
- Multi-channel Architecture
  – Up to 640 or More Phase-locked Channels
- Independent Edge Placement
- Channel Deskew
- Precision Channel-to-channel Timing Alignment
- 1 ps Timing Resolution
- GPIB (IEEE 488) Programmable
- Modular Construction

BENEFITS

- Upgrade Capability
- Maximum Control and Flexibility

Applications

- Characterize CMOS, ECL, ACL, BiCMOS, and GaAs Devices



HFS Series

HFS 9000 STIMULUS SYSTEM

When product designs were simple, and time-to-market not so critical, designers could afford the days, or even weeks, necessary to assemble, program, debug and characterize the various elements of a stimulus system and its fixturing. As product design complexity and market pressures have increased, however, designers of high-speed, high-performance circuits simply cannot afford this expenditure in time.

Now there's a solution. With Tektronix HFS 9000 Stimulus Systems we've taken the features of a high-performance pulse generator, made them better, and added complete data generation capabilities as well. We've eliminated the need for a switch matrix since we have data and timing on every pin. And the need for a separate power supply is gone, as the HFS 9000 has the ability to produce the DC levels needed to drive logic lines directly. Finally, all these capabilities are present on every pin simultaneously, so you get extremely flexible formatting. Now you can set up a complete stimulus system in minutes, rather than hours or days, and test products more thoroughly throughout the development cycle.

DIGITAL ARCHITECTURE

The HFS 9000 Series products were designed as completely programmable digital instruments rather than being based on traditional monostable analog architecture. This allows more capability and flexibility in pulse edge placement without the restrictions that analog instruments commonly impose. Now you can adjust both Delay and Width from 0 to 20 µs over all frequencies.

MODULAR DESIGN

You can build a stimulus system with from four to 36 channels in one mainframe, and 640 or more channels across multiple phase-locked mainframes. Choose from the HFS 9003 mainframe with 3-slot, 12-Channel capability, or the HFS 9009 mainframe with 9-slot, 36-Channel capability. Both systems can include the 4-Channel HFS 9DG1 and HFS 9DG2 Data Time Generator cards in any combination.

All channels are slaved to a common clock, resulting in highly accurate channel-to-channel edge placement. This makes the HFS 9000 ideal for precise characterization and evaluation of synchronous devices having multiple, and possibly interactive, inputs.

FULL CHANNEL DESKEW CAPABILITY

All HFS 9000 channels have independent, wide deskew ranges to allow precise pulse alignment and timing at the device under test (DUT). Deskew compensates for the timing differences caused by cabling and fixturing so your analysis can be focused on the relative timing at the DUT.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

Programmable Stimulus System

HFS 9003 • HFS 9009 • HFS 9DG1 • HFS 9DG2

1 PS TIMING RESOLUTION
No other system lets you generate whatever combination of signals is required, with data and timing on every pin with 1 ps resolution. Now you can create data buses, clocks, strobes, gated clocks, logic level sources, pseudorandom bits and other stimuli with unequaled accuracy. You can perform setup and hold time margin tests by providing the clock, data, set and reset signals to the DUT. And you can hold inactive signals at programmable high or low logic levels, eliminating the need for external DC voltage sources and microwave switches.

630 MHZ REPETITION RATE
Accurate and repeatable AC measurements of prop delay, setup and hold time, and maximum operating frequency (fmax) require fast rep rates and edge speeds. With repetition rates up to 630 MHz, the HFS 9000 is ideal for characterizing the most advanced logic families, and it can be used for testing component compliance with the SONET telecommunications standard. Transition times as fast as 250 ps (20%–80%) enable repeatable and accurate testing of the highest-speed ECL and GaAs digital devices. Variable transition time control from 800 ps to 6 ns is also available with the appropriate output levels for testing advanced CMOS, BiCMOS and TTL logic families.

EASY EDITING OF SETUPS AND VECTORS
Edit setups and vectors easily with BitWriter© Software. With this Microsoft Windows based package you can build a complete test setup, including timing parameters, voltage levels, channel assignment and test vectors on your PC. Ideal for remote test development. Individual setups and test vectors can be uploaded and stored when the HFS 9000 has multiple users.

FULLY PROGRAMMABLE
Programmability is important in developing automated, repeatable tests in R&D, incoming inspection, and production of high-speed components. Therefore, the HFS 9000 offers full implementation of the new IEEE 488.2 standard and utilizes Tektronix Codes and Formats. GPIB/RS-232 ports provide for remote, fully programmable control. Coupled with a high-speed acquisition system, such as the 11801B Digital Sampling Oscilloscope, or the most advanced logic analysis system on the market – the Tektronix DAS 9200 Digital Analysis System – a fully automated test system can be developed with unequaled accuracy and repeatability.

PHASE LOCK MODE
Phase lock-in allows the internal time base to be phase-locked to an external frequency source. This "supercharger" capability can be used to augment the speed performance of automated component test systems by creating synchronized signals as fast as 630 MHz.

CONFIGURATION OPTIONS
Card-modular design lets you adapt to any logic family from within the same mainframe. Choose the HFS 9DG1 Data Time Generator card for 630 MHz bandwidth and <250 ps fixed rise time. The 9DG1 provides four channels of stimulus. This card is ideal for ECL and GaAs device characterization.

Or, choose the HFS 9DG2 Data Time Generator card for up to 315 MHz bandwidth and variable transition times from 800 ps to 6 ns. The 9DG2 provides four channels of stimulus. This card is ideal for simulating TTL, CMOS and BiCMOS logic signals.

Combine these cards in any combination for testing a broad range of components or systems with mixed logic families.

APPLICATIONS
From verifying critical parameters to full characterization, from developing manufacturing test vectors on the bench to phase-locked at-speed testing in conjunction with production test systems, the HFS 9000 Data Time Generator simplifies the process while adding unmatched capabilities. You can, for example, create complex stimuli that are impossible with other systems. Download test vectors and timing parameters to the HFS 9000 to set up worst-case conditions and to stimulate each pin in isolation. Vary voltage levels, pulse widths and timing relationships independently for each channel. Mix high-speed and variable transition time modules to fit your logic family, and obtain channel counts unavailable in any other discrete instrument.

The Data Time Generator also provides a new dimension of assistance in characterizing pattern sensitivity. It provides the data stream while also creating the varying signal levels, timing relationships or signal characteristics required to detect pattern sensitivity across worst-case operating conditions.

Capabilities like these allow you to perform full characterizations on the first run, lowering your development costs and reducing your time to market.

Characteristics

Level Resolution – 0.01 V.

HIGH Level Accuracy – ±2% of level ±50 mV.

LOW Level Accuracy – ±2% of HIGH level ±2% of amplitude ±50 mV.

Output Aberrations (200ps after 50% pt.) –
Overshoot: +15% +20 mV.
Undershoot: –10% –20 mV.

TIME BASE PERFORMANCE
Frequency Range – 50 kHz to 630 MHz.

Frequency Resolution – ≤0.1% of programmed value.

Frequency Accuracy – ±1% of programmed value.

RMS Jitter – 15 ps ±0.05% of interval.

PHASE LOCK IN Frequency Range – 6 MHz to 630 MHz.

PHASE LOCK IN Amplitude Range – 0.8 V to 1.0 V p-p.

Output Frequency Range – any 2^n multiple or submultiple of PHASE LOCK IN frequency. Must remain inside the allowed frequency range for installed cards.

FRAME SYNC IN – Initiates a burst when using PHASE LOCK IN external frequency reference.

OUTPUT EDGE PLACEMENT PERFORMANCE
Channel Deskew Range – Minus 60 ns to 2.0 µs.

Channel Deskew Resolution – 1 ps.

DELAY Adjust Range – 0 to 20 µs.

DELAY Adjust Resolution – 1 ps.

DELAY Accuracy – 1% ±50 ps.

WIDTH Adjust Range – 0 to 65,536 times one period.

WIDTH Adjust Resolution – 1 ps.

WIDTH Accuracy – HFS 9DG1: 1% of width ±50 ps; HFS 9DG2: 1% of width +50 ps –250 ps.

Continued on next page.

Programmable Stimulus System

HFS 9003 • HFS 9009 • HFS 9DG1 • HFS 9DG2

OUTPUT PERFORMANCE

	HFS 9DG1	HFS 9DG2
Outputs	4 differential	4 single-ended
Maximum HIGH level	+5.00 V	+5.50 V
Minimum LOW level	–2.50 V	–2.00 V
Max p-p amplitude	3.00 V	5.50 V
Min p-p amplitude	0.01 V (10 mV)	0.01 V (10 mV)
Output transition time (20% to 80%)	<250 p (≤1 V p-p)	variable 800 ps to 6 ns

TRIGGER INPUT PERFORMANCE

Input Resistance – 50 Ω.

Input Voltage Range – ±5 V maximum.

Programmable Threshold Range – –4.70 V to +4.70 V.

Programmable Threshold Resolution – 100 mV.

Programmable Threshold Accuracy – ±100 mV ±5% of level.

Minimum Input Pulse Width – 1 ns.

Input Rise/Fall Time Requirement – ≤10 ns.

Sensitivity – ≤500 mV.

POWER REQUIREMENTS

Line Voltage Ranges – 90 V AC to 130 V AC RMS, and 180 V AC to 250 V AC RMS; range switched automatically for HFS 9003 (factory configured for HFS 9009).

Line Frequency – 48 Hz to 63 Hz.

Power Consumption –

	HFS 9003	HFS 9009
Maximum	540 W	900 W
Typical	400 W	750 W

ENVIRONMENTAL

Temperature – Operating: 0° to +50°C (HFS 9003); 0° to +40°C (HFS 9009). Nonoperating: –40° to +75°C.

Humidity – –10°C to +30°C up to 95% relative humidity. 30°C to 40°C up to 75% relative humidity.

Altitude, Shock Nonoperating, Bench Handling – Meets MIL-T-28800C, Type III, Class 5.

PHYSICAL CHARACTERISTICS

HFS 9003	Cabinet		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	414	16.3	483	19.0
Height	178	7.0	178	7.0
Depth	629	24.75	629	24.75
Weight*[1]	**kg**	**lbs.**	**kg**	**lbs.**
Net	20.5	45.0	23.2	51.0
Shipping	27.3	60.0	30.0	66.0

[1] Maximum configuration.

HFS 9009	Cabinet	
Dimensions	**mm**	**in.**
Width	426	16.75
Height	356	14.0
Depth	610	24.0
Weight	**kg**	**lbs.**
Net	36.8	81.0
Shipping	45.5	100.0

HFS 9DG1, HFS 9DG2	Cabinet	
Dimensions	**mm**	**in.**
Width	51	2.0
Height	267	10.5
Depth	356	14.0
Weight	**kg**	**lbs.**
Shipping	1.36	3.0

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

HFS 9003
3-Slot Mainframe.
Includes: Traceable Calibration Certificate; User Reference Manual; Service Reference Manual; Power Cord; RS-232 Pigtail; SMA-BNC Adapter; Zip-Lock Pouch; Two Replacement Fuses; and One 50 Ω SMA Coaxial Cable.

Opt. 1R – Rackmount.

Opt. 95 – Calibration Data Report

HFS 9009
9-Slot Mainframe.
Includes: Traceable Calibration Certificate; User Reference Manual; Service Reference Manual; Power Cord; RS-232 Pigtail; SMA-BNC Adapter; Zip-Lock Pouch; Two Replacement Fuses; and One 50 Ω SMA Coaxial Cable.

Opt. 95 – Calibration Data Report

ACCESSORIES
See page 438 for Cables, Adapters, and Terminators.

HFS 9DG1
Four differential data time outputs per card with <250 ps transition time, 630 MHz.
Includes: Installation Instructions and Two Clock Cables.

HFS 9DG2
Four single-ended data time outputs per card with 800 ps to 6 ns variable transition time.
Includes: Installation Instructions and Two Clock Cables.

S85HFS1 – BitWriter® Software.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

Data Generator

New DG2020 • P3410/P3420

Features

DG2020 AND P3410/P3420

- 200 Mbits/s Maximum Output Data Rate
  - Up to 64 K Words/Channel Data Word Length
- Up to 36 Output Channels in 12-Channel Increments
- Up to 12 Independent Variable Delay Output (20 ns, 100 ps Minimum Resolution)
- Output Level
- P3410 TTL Level
- P3420 Variable Voltage Output from –2 V to +7 V
- Flexible Sequence Control and Data Jump
- Try-state Control
- Powerful and Easy- to- use Data Built-in Editor
- Data Import from Various Instrument and Other Source

BENEFIT

- Upgrade Capability

Applications

- Replicate Vector Data from Simulator
- Characterize a Device's Timing and Amplitude Margin
- Replicate Data from Unavailable Part of the System
- Inject Infrequent Faults to Test Fault Tolerance
  - Semiconductor (ASIC/FPGA/ DAC)
  - Storage Media Write Data (HDD/ FDD/MO/DVD..)
  - CCD (Area, Liner) Image Sensor
  - Printer, Copy (Color/Laser) Digital Graphic Data
  - LCD (STN/TFT/MIM..) Display Device Drive/Control
  - Logic Board/Bus Simulation

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

New DG2020/P3410/P3420

DG2020 Data Generator and P3410/P3420 Output Pod

The DG2020 digital data generator combines the high performance needed to test the latest technology devices with unprecedented ease of digital Data creation and modification. The DG2020 is used to replicate valid, marginal and erroneous digital conditions that a design could encounter. DG2020 is very useful data generator for a hardware design engineer performing functional test, debug, or characterization on digital subsystems, circuit boards or components. Capabilities such as two types of output pod, advanced sequencing (looping), and flexible editors make the DG2020 a powerful addition to your suite of test instruments.

DATA OUTPUT

The DG2020 offers the data rate up to 200 Mbps, 64 K data words length, up to 36 output channels in 12-Channel increments and 100 ps timing delay control up to 20 ns function in the portable main frame.

P3410 output pod provides TTL level signal from a grouped pin-header connector.

P3420 variable output pod provides 500 mV to 9 Vpp (–3 V to 7 V), 100 mV increment that cover ECL, TTL CMOS logic level. Output connections consist of independent SMB connectors for each channel. The P3420 is capable of >30 mA of current sourcing, enough for your most demanding applications.

POWERFUL AND EASY-TO-USE DATA BUILT-IN EDITOR

The powerful built-in Data creation and editing capability allows you to create and modify your data streams quickly and easily. Data can be graphically created using the built-in functions including counters, shift registers, serial data and clocks.

EXTENDED FUNCTIONARY WITH SEQUENCING

Sequencing is a capability that extends the 64 K record length and allows external events to control data flow. Each line in the sequencer can be controlled by an external event that can cause a jump to a different block of data. The DG2020 can have up to 4096 jumps (one per line) at the full 200 MHz clock rate and has specified latency that can be accounted for. The P3410 and P3420 output pods have two input signals, Event and Inhibit that can control the flow and impedance of the sequence.

IMPORT THE DATA FROM OTHER SOURCES

Getting data into the DG2020 is simple with multiple import options from several sources. Data can be imported from several instruments including the Tektronix TLS216 logic scope, GPX logic analyzer, 2000 series arbitrary waveform generators, and TDS series scopes. To import data from other sources, a comma separated variable (CSV) format is supported.

Data Generator

New DG2020 • P3410/P3420

Characteristics

DG2020

Output Data –
Data Rate: –0.1 bps to 200 Mb/s.
Sampling rate: 0.1 Hz to 200 MHz.
Resolution: 4 digits.
Period jitter: <50 ps RMS (at 200 MHz).
Accuracy: PLL On, ±50 ppm; PLL Off, ±3%.
Data Depth – 64 K to 64 K word (1 increment).
Data Width – 12-Bits (std), 24 or 36-Bits (optional).

Sequencer –
Max number of lines: 4096.
Max Data repeats per line: 65536 or infinite.
Max number of jumps per sequence: 4096.

AUXILIARY INPUT

Clock – SMB Connector (Rear)
Threshold level: V_{IH} >0.7 V, V_{IL} <0.3 V.
Maximum input voltage: ±2 V.
Frequency: DC to 200 MHz.
Impedance: 50 Ω, terminated to +0.5 V.

Trigger – BNC Connector (front)
Level: –5.0 V to +5.0 V.
Resolution: 0.1 V.
Impedance: 1 KΩ or 50 Ω.
Hold off: 500 ns minimum.

AUXILIARY OUTPUT

SYNC Output –BNC Connector (Front)
Level: Positive TTL pulse. 50 Ω.
Output Term: 6 Clocks.

EVENT Output – BNC Connector (Front)
Level: Positive TTL pulse. 50 Ω.
Output Term: 8 Clocks.

CLOCK Output – SMB Connector (Rear)
Level: 1 V (Typical) into 50 Ω.
Delay from Trigger Input
Internal
(Pll on): <60 ns ±0.5 clock (>6.25 MHz)
<70 ns ±0.5 clock (6.25 MHz)
(Pll off): <60 ns (>6.25 MHz)
<70 ns (6.25 MHz)
External: <45 ns + (1±0.5) clock.
Delay from External Clock Input: <25 ns.

ENVIRONMENTAL

Temperature –
Operating: +10°C to +40°C.
Nonoperating: –20°C to +60°C.

Humidity –
Operating: 20% to 80% (no condensation).
Nonoperating: 5% to 90% (no condensation).

Altitude –
Operating: To 4.5 km (15,000 ft.).
Maximum operating temperature decreases 1°C each 300 m above 1.5 km.
Nonoperating: To 15 km (50,000 ft.).

Vibration – Operating: 0.33 mm p-p, 10 to 55 Hz, 15 minutes.

Shock – Nonoperating: 294 m/s² (30 G), half-sine, 11 ms duration.

CERTIFICATION AND COMPLIANCE

Certifications –
Safety: Designed to meet UL 1244 and CSA 22.2 No. 231 (M-89).

EC Declaration of Conformity –
Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility.

POWER

AC Line Power –

Voltage Range	Line Frequency
90 to 250 V AC	48.0 to 63.0 Hz
90 to 127 V AC	48.0 to 440 Hz

Nominal Voltage – 100 V, 115 V, 200 V, 230 V, 240 V.

Maximum Power – 300 W.

Maximum Current – 4 A.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height (with feet)	164	6.4
Width: (with handle)	362	14.3
Length: (with front cover)	491	9.25
Length (with handle extended)	576	22.2
Weight	**kg**	**lbs.**
Net	9.7	21.4

DATA OUTPUT POD – P3410 12 CHANNELS TTL POD

Connector – 26-Pin Header
^{V}OH; >4.4 V into 1 MΩ.
^{V}OL; >0.1 V into 1 MΩ.

Rise/fall time – <5 ns into 1 MΩ 10 pF.

Event Input –
Threshold level: TTL.
Delay to Data Output: ≤50 ns + 50 clock.

Inhibit Input –
Level: TTL 1 KΩ.
Delay to Data Output: 18 ns.
Internal inhibit delay: 5 ns.
Internal Clock out to Data Delay: 24 ns.
External Clock Input to Data Output Delay: <45 ns.

Trigger Input to Data Output Delay –
Internal Clock: <70 ns (>6.25 MHz)
<80 ns (≤6.25 MHz)
External Clock: <70 ns +(±0.5) clock.

Data Generator

New DG2020 • P3410/P3420

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height: (including feet)	51	2.0
Width:	150	5.9
Length:	101	4.0
Weight	**kg**	**lbs.**
Net	0.5	1.1

P3420 12 CHANNELS VARIABLE POD
Connector: SMB
V_{OH}; −2.0 V to +7.0 V into 1 MΩ
V_{OL}; −3.0 V to +6.0 V into 1 MΩ.
Resolution: 0.1 V
Maximum swing: 9.0 V_{p-p}.
Minimum swing: 0.5 V_{p-p}.

Output Current –
Total output current: <500 mA
Sink: <−30 mA.
Source: >+30 mA.
Rise/fall time: <4 ns into 1 MΩ10 pF, 5 V_{p-p} swing.

Event Input –
Threshold level: −5.0 V to +5.0 V.
Resolution: 0.1 V.
Delay to Data Output: ≤45 ns + 50 clock.

Inhibit Input –
Threshold level: −5.0 V to +5.0 V. 1 K.
Resolution: 0.1 V.
Delay to Data Output: 16 ns.
Internal inhibit delay: −2 ns
Internal Clock out to Data Output Delay: 20 ns.
External Clock Input to Data Output Delay: <40 ns.

Trigger Input to Data Output Delay –
Internal Clock: <65 ns (>6.25 MHz)
<75 ns (≤6.25 MHz)
External Clock: <65 ns +(±0.5) clock.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height:(including feet)	51	2.0
Width:	255	10
Length:	161	6.3
Weight	**kg**	**lbs.**
Net	1.0	2.2

P3410/P3420 COMMON
Delayed Channels –
Delay channel: CH 8, CH 9, CH 10, and CH 11.
Delay time: 0 to 20 ns.
Delay resolution: 0.1 ns.

Channel Skew –
<3 ns (CH 0 and other channels, same pod).
<2 ns (CH 0 and CH 0, two pods of same type).

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DG2020
Data Generator
Includes: User Manual (070-9448-00), Programmer Manual (070-9449-00), 3.5-in. Performance Check Disk (063-1899-00), Pod Connection Cable (174-3548-00), Power Cord 125 V/6A (161-0230-01), ISO qualified Inspection Passed Certificate.

Order P3410 or P3420 pod separately.

Opt. 01 – 24-CH output. Adds a 12-Bit digital port for a total of 24-Channels. Includes output cables (015-1502-00) for 12-Channels. Order P3410 or P3420 pod separately.

Opt. 02 – 36-CH output. Adds two 12-Bit digital ports for a total of 36-Channels. Includes output cables (015-1504-00) for 12-Channels. Order P3410 or P3420 pod separately.

Opt. 1R – Rackmount. Floppy Drive Access Moved to Front.

Opt. 95 – Test result report provided with the DG2020.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

P3410
TTL-level Pod with 12 Output Channels
Includes: Output cables (015-1502-00) for 12-Channels.

Opt. 95 – Test result report provided with the P3410.

P3420
Variable-level Pod with 12 Output Channels)
Includes: Output cables (015-1504-00) for 12-Channels.

Opt. 95 – Test result report provided with the P3420.

ACCESSORIES
SMB to Pin Header Cable (20 in.) – 012-1506-00.
SMB to Pin Header Cable (50 in.) – 012-1503-00.
Pin header to Pin Header Cable – 012-1505-00.
SMB to SMB Cable (40 in.) – 012-1458-00.
SMB to BNC Cable (40 in.) – 012-1459-00.
1-CH Pin Lead set (set of 5) – 012-1508-00.
4-CH Pin Lead set (set of 3) – 012-1509-00.
Connector (for Pin Header) – 131-5919-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

Bench and Handheld Test Instruments

Tektronix has a complete line of low-cost bench and handheld test instruments for both basic and advanced test benches: triple output power supplies, digital multimeters, function generators, multifunction counter, digital thermometers and digital clamp meters.

Instrument and operator safety are all-important. Tektronix Series instruments comply with independent safety certification standards.

CONTENTS

BENCH TEST INSTRUMENTS

Power Supplies 408
Programmable Power Supplies 410
Digital Multimeter 412
Function Generators 413
Counter 415

HANDHELD TEST INSTRUMENTS

Digital Multimeters 416
Digital Thermometers 421
Digital Clamp Meter 422
Handheld Accessories 423

Bench Test Instruments

POWER SUPPLIES

The CPS250 and PS280 power supplies are versatile instruments with one fixed and two variable outputs. Two switchable analog meters (CPS250) or digital readout (PS280) and switchable outputs operating independently, in series, or in parallel, make these power supplies ideal for lab and field work. If your needs require programmability, look at our PS2500G Bench Series power supplies.

DIGITAL MULTIMETER (BENCH)

Tektronix digital multimeters measure AC and DC voltage, current and resistance.

FUNCTION GENERATORS

Tektronix Function Generators produce TTL signals and square, sine, and triangle waves for testing amplifiers, filters, and digital circuits. The frequency range of these Tektronix instruments runs from 0.1 Hz to 11 MHz. Sweep functions can be controlled internally or by an external signal.

The CFG280 includes a 1 Hz to 100 MHz integral counter.

COUNTER

Tektronix benchtop counters accurately measure the frequency of sine, square and triangle waves. The counters span the frequency range from 1 Hz to 1.3 GHz.

The CMC251 has a temperature-compensated time base to ensure accurate performance in changing ambient conditions. Service technicians will find this meter useful as a standard for calibrating other equipment.

Handheld Test Instruments

DIGITAL MULTIMETERS

Our DMM 900 Series delivers higher accuracy and better resolution than competing DMMs. These smart, compact handheld instruments offer ground-breaking innovation, including a dual-numeric display for reading simultaneous measurements and AC+DC volts for measuring True Total RMS. The DMM200 Series Multimeters are professional DMMs that offer True RMS voltage measurements with features and accuracy you need to solve your tough problems. The DMM150 Series Multimeters offer features you need with affordable pricing.

DIGITAL THERMOMETERS

Whether you work in process control, HVAC or food engineering, the DMT900 Series thermometers provide high-quality performance and environmental durability at a very attractive price.

DIGITAL CLAMP METER

Better performance for a great price – that's what the DCM910 Current Clamp with autoranging and True RMS readings offers. On the bench or in the field, Tektronix quality and superior warranty keep you protected.

HANDHELD ACCESSORIES

A full line of accessories are available to complement your handheld test equipment. Current probes, test leads and clips, temperature probes, carrying cases along with THS700 oscilloscope accessories expand the capabilities of your equipment.

Power Supplies

CPS250 • PS280

Features

CPS250

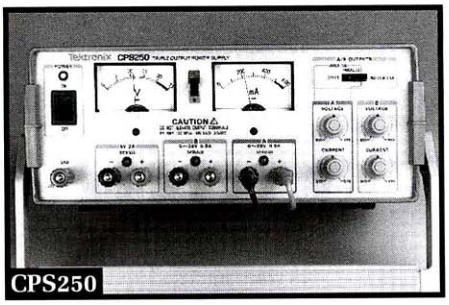
- Triple Output Power Supply
- Two Variable 0 to 20 V, 0.5 A Supplies
- Fixed 5 V, 2 A Supply
- Variable Current Limiting
- Overload Indicators

PS 280

- One Fixed 5 V, 3 A Supply
- Two Variable Outputs, 0 to 30 V, 2 A
- Variable Current Limiting
- Selectable Independent Tracking Mode
- Dual Tracking, Variable 0 to 30 V, 2 A

Applications

- Training
- Manufacturing Production Test
- Field Repair
- Bench Calibration and Repair
- Product Design



CPS250

CPS250

The CPS250 Triple Output Power Supply is a versatile instrument with two variable and one fixed output. Its attractive, compact design with tilt-bail handle takes up less bench space than most other power supplies. It meets most basic test and lab bench requirements.

PS280 Power Supply

The Tektronix PS280 Laboratory DC Power Supply is a multifunction benchtop or portable instrument. This regulated power supply provides fixed 5 V output for powering logic circuits and two variable outputs for a wide variety of test and experimental uses.

The PS280 contains two identical, independently adjustable DC power supplies that can vary from 0 to 30 V, and 0 to 2 A. Front-panel switches select one of three modes of operation: independent, series, or parallel.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Power Supplies
CPS250 • PS280

KEY SPECIFICATIONS

	CPS250	PS280
Output Voltage		
Two Variable	0 to 20 V DC	0 to 30 V DC
One Fixed	5.0 V	5.0 V
Output Current		
Two Variable	0 to 0.5 A (CC)*1	0 to 2.0 A (CC)*1
One Fixed (foldback limited)	2.0 A max	3.0 A max
Line Regulation		
Two Variable	0.01% + 3 mV (CV); 0.2% + 3 mA (CC)	0.01% + 3 mV (CV); 0.2% + 3 mA (CC)
One Fixed	≤10 mV (CV)	≤5 mV (CV)
Load Regulation		
Two Variable	0.01% + 3 mV (CV); 0.2% + 6 mA (CC)	≤0.01% + 5 mV, current > 3 A (CV); ≤300 mV, 0 to 60 V single series tracking supply (CV); 0.2% + 3 mA (CC)
One Fixed	0.1% + 5 mV (CV)	≤10 mV (CV)
Ripple/Noise		
Two Variable	2 mV RMS, 5 Hz to 1 MHz (CV); 3 mA RMS, 5 Hz to 1 MHz (CC)	≤1 mV RMS, 5 Hz to 1 MHz (CV); ≤3 mA (CC)
One Fixed	2 mV RMS	≤2 mV RMS
Output in Independent Mode		
	Two variable 0 to 20 V (CV); 0.5 A (CC)	Two variable 0 to 30 V (CV); 2.0 A (CC)
Output in Parallel Mode	One 0 to 20 V, 1.0 A max	One 0 to 30 V, 4.0 A max
Tracking Error	±0.2% ± 20 mV	≤0.5% + 10 mV
Series Mode	One 0–40 V, 0.5 A max or one ±20 V, 0.5 A	One 0 ±30 V, 2.0 A max or one 60 V, 2 A
Tracking Error	±0.2% ±20 mV	±0.5% + 10 mV
Displays	Two analog meters (switchable)	Two 3-1/2 digit LED (switchable)
Voltage Indicator	0 to 25 V DC ± 2.5% of full scale	0 to 30 V DC ± (0.5% of rdg + 2 digits)
Current Indicator	0 to 800 mA ± 2.5% of full scale	0 to 2 A DC ± (0.5% of rdg + 2 digits)
Overload Indicator	Yes	Yes
Insulation		
Chassis to Terminal	>50 MΩ at 500 V DC	≥20 MΩ at 500 V DC
Chassis to Power Cord	>50 MΩ at 500 V DC	≥30 MΩ at 500 V DC
Safety Certification	UL, CSA, T-MARK	ETL, CSA, T-MARK

**1 (CC): When operated in Constant Current mode. (CV): When operated in Constant Voltage mode.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CPS250
Triple Output Power Supply.
Includes: Operator's Manual, 3 pairs of Test Leads, US Power Cord, One Year Warranty.

PS280
Triple Output 0 to 30 V/2 A Power Supply.
Includes: Operator's Manual, 3 pairs of Test Leads, US Power Cord, One Year Warranty.

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Programmable Power Supplies

PS2520G • PS2521G

Features

PS2520G

- Triple Output
- One 0 to 6 V, 0 to 3 A
- Two 0 to 36 V, 0 to 1.5 A
- Digital LED Output Indicator
- SCPI Compatible

PS2521G

- Triple Output
- One 0 to 6 V, 0 to 5 A
- Two 0 to 20 V, 0 to 2.5 A
- Digital LED Output Indicator
- SCPI Compatible

Applications

- Training
- Manufacturing Production Test
- Field Repair
- Bench Calibration and Repair
- Product Design

PS2520G/PS2521G

The triple output PS2520G and PS2521G Power Supplies are versatile supplies suitable for many applications. The PS2520G has a single supply providing a maximum of 6 V and 3 A and two supplies providing a maximum of 36 V and 1.5 A. The PS2521G has a single supply providing a maximum of 6 V and 5.0 A and two supplies providing a maximum of 20 V and 2.5 A.

The supplies can be operated in one of three modes: independent, series, or parallel. In the independent mode, the output voltage and current of each supply are controlled independently. In the two tracking modes, the variable outputs are connected either in series or in parallel; the controls of the master power supply adjust the voltage or current of both power supplies.

The PS2520G and PS2521G are GPIB programmable. The GPIB command sets are SCPI compatible.

Each power supply features 100 memories to store voltage and current limits for instant recall via the front panel or GPIB.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Programmable Power Supplies

PS2520G • PS2521G

KEY SPECIFICATIONS

	PS2520G	PS2521G
Number of Outputs	3	3
Output Voltage	0 to 6 V, 0 to 36 V (two)	0 to 6 V, 0 to 20 V (two)
Output Current	0 to 3 A (6 V), 0 to 1.5 A (36 V)	0 to 5 A (6 V) 0 to 2.5 A (20 V)
Voltage Accuracy	0.05% 5 mV + 25 mV	0.05% 5 mV + 25 mV
Current Accuracy	0.2% + 10 mA	0.2% + 10 mA
Programmable Voltage Resolution	10 mV	10 mV
Programmable Current Resolution	1 mA	1 mA
Display	Digital LED	Digital, LED
Auto-series/Parallel Operation	Yes	Yes
Auto-master/Slave Tracking	Yes	Yes
Internal Memory	Yes, 100	Yes, 100
GPIB (SCPI)	Yes	Yes
Constant Voltage Mode	Yes	Yes
Constant Current Mode	Yes	Yes
Variable Current Limit	Yes	Yes
Over-voltage Protection	Yes	Yes
Over-current Protection	Yes	Yes
Dual 4-Digit Panel Meter	Yes	Yes
Safety Certifications	ETL, CSA	ETL, CSA

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

PS2520G
Triple Output Programmable Power Supply.

PS2521G
Triple Output Programmable Power Supply.
All Include: User Manual, US Power Cord, 3 Pair Black/Red Test Leads.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufacturing ISO registered facilities.

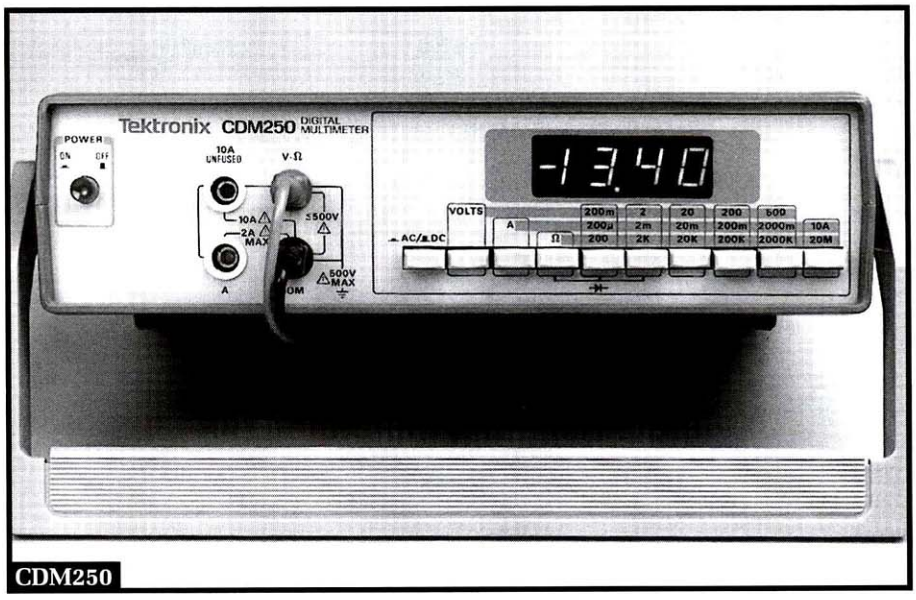
Digital Multimeter (Bench)
CDM250

Features

CDM250
- AC/DC Volts (500 V Range)
- Resistance (20 MΩ Range)
- Current (10 A Range)
- Overload Protection

Applications

- Training
- Manufacturing Production Test
- Field Repair
- Bench Calibration and Repair
- Product Design



CDM250

CDM250

The CDM250 Digital Multimeter measures and displays voltage, current, and resistance using a 3 1/2 digit LED display. Sine wave alternating voltages and currents are displayed in RMS values. The CDM250 is safe and easy to use in the classroom and on the job. This meter has overload protection and is UL listed and CSA certified. Test leads are included.

KEY SPECIFICATIONS

DC Voltage Ranges – 200 mV, 2 V, 20 V, 200 V, 500 V.

Basic DC Volts Accuracy – ±(0.5% of reading + 1 count).

Max DC Input Voltage – 500 V DC (DC + peak AC).

AC Voltage Ranges – 200 mV, 2 V, 20 V, 200 V, 500 V.

Basic AC Volts Accuracy – ±(1.0% of reading + 4 counts).

Max AC Input Voltage – 350 V AC RMS; 500 V (DC + peak AC).

DC Current Ranges – 200 µA, 2 mA, 20 mA, 200 mA, 2 A, 10 A.

Basic DC Current Accuracy – ±(1.0% of reading + 1 count).

Max DC Input Current – 2 A fused, 10 A unfused.

AC Current Ranges – 200 µA, 2 mA, 20 mA, 200 mA, 2 A, 10 A.

Basic AC Current Accuracy – ±(1.5% of reading + 4 counts).

Max AC Input Current Voltage– 650 V pk, A to COM.

Resistance Ranges – 200 Ω , 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ, 20 MΩ.

Basic Resistance Accuracy – ±(0.75% of reading + 1 count).

Max Resistance Input Voltage – 500 V (DC + peak AC).

Warranty – One year.

Safety Certification – UL Listed, CSA Certified.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CDM250
Digital Multimeter.
Includes: Test Leads, Operator's Manual, US Power Cord, One Year Warranty.

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

Function Generators

CFG253 • CFG280

Features

CFG253

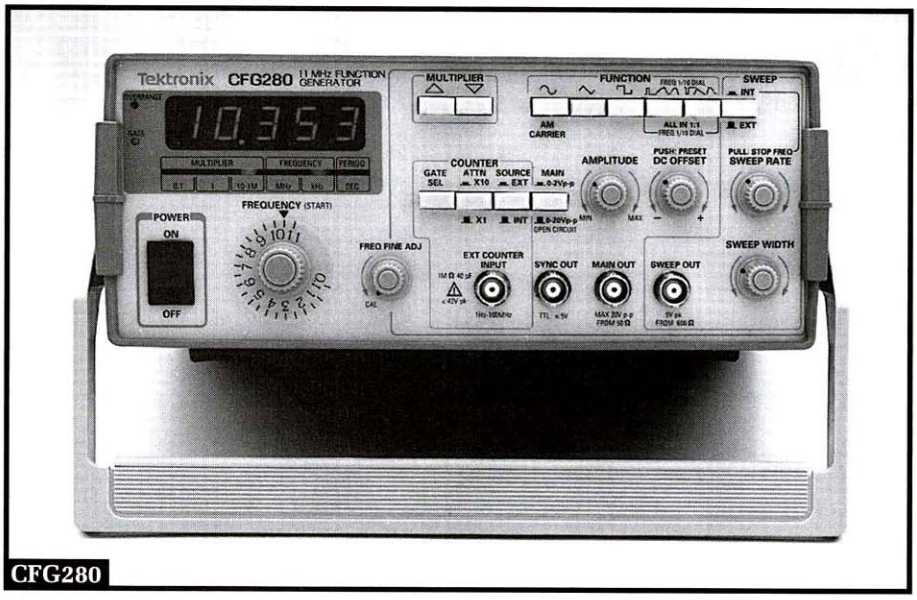
- 0.03 Hz to 3 MHz
- Square, Triangle, and Sine Waves; TTL Output
- 20 dB Attenuator
- Internal or External Frequency Sweep
- Variable Duty Cycle
- Variable Symmetry (20 to 80%)

CFG280

- 0.1 Hz to 11 MHz (Calibrated)
- 0.01 Hz to 11 MHz (Uncalibrated)
- 1 Hz to 100 MHz Counter
- Square, Triangle, and Sine Waves; TTL Output
- 20 dB Attenuator
- External Gate Input
- VCF (FM) Input
- AM 0 to 100% Input for External Sine Wave
- Internal or External Frequency Sweep

Applications

- Training
- Manufacturing Production Test
- Field Repair
- Bench Calibration and Repair
- Product Design



CFG280

CFG253

Function Generators produce sine, square, and triangle waves, and TTL signals for testing amplifiers, filters, and digital circuits. Sweep function can be controlled internally or with an external signal. Duty cycle, DC offset, sweep rate, sweep width, and amplitude are all operator controlled. The CFG253 has output bandwidth of 0.03 Hz to 3 MHz.

CFG280 11 MHz Function Generator with Counter

The CFG280 combines an 11 MHz Function Generator with a 1 Hz to 100 MHz Frequency Counter. The on-board counter allows the operator to set the frequency output of the function generator precisely. This versatile instrument conserves both bench space and budget.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Function Generators

CFG253 • CFG280

KEY SPECIFICATIONS

	CFG253	CFG280
Waveform Outputs	Square wave, sine wave, triangle wave, TTL pulse, sweep functions for all outputs	Square wave, sine wave, triangle wave, TTL pulse, sweep functions for all outputs
Ranges	1.0 Hz to 1.0 MHz in 7 ranges	0.1 Hz (calibrated) to 11 MHz in 8 ranges
Frequency Multiplier	Variable from 0.3 to 3.0 times the selected frequency range	Variable from 0.1 to 1 (uncalibrated) 1 to 11 (calibrated)
Dial Accuracy	±5% of full scale	±5% of full scale from 0.1 Hz to 10 MHz
Sine Wave Distortion	<1% (10 Hz to 100 kHz)	<1% (10 Hz to 100 kHz) −30 dB at all other frequencies
Triangle Wave Linearity	20 Hz to 200 kHz: ≥99%; 200 kHz to 3 MHz: ≥97%	0.1 Hz to 110 kHz: ≥99%; 110 kHz to 1 MHz: ≥97%; 1 MHz to 11 MHz: ≥95%
Square Wave Response	≤100 ns rise/fall time, maximum output into 50 Ω load	≤25 ns rise/fall time, maximum output into 50 Ω load
Main Output Amplitude	0 to 20 V p-p	0 to 20 V p-p
Attenuator	20 dB	20 dB
SYNC/TTL Output	TTL output level, rise <25 ns (20 TTL load) ≥3 V pk	<25 ns rise/fall time, maximum output into 50 Ω load
Main Output Impedance	50 Ω ±10%	50 Ω ±10%
DC Offset (continuously variable)	±10 V minimum open circuit; ±5 V minimum into 50 Ω load	±10 V minimum open circuit; ±5 V minimum into 50 Ω load
Symmetry/Duty Cycle	5 to 1 minimum symmetry change	95/5 fixed (pulse and ramp)
Internal Variable Sweep Rate	0.5 Hz to 50 Hz	0.5 Hz to 50 Hz
External Voltage-controlled Variable Sweep Range (10 kΩ Input)	100:1 minimum for 0 to +10 V DC input with frequency control set at maximum	100:1 minimum for 0 to ±10 V DC input with frequency control set at 0.1 or 11
VCF (FM) Input	–	±10 V input shifts frequency ≥100:1 up or down with dial set at 0.1 or 11 respectively
AM	–	0 to 100%, DBSC, external sine wave only
Warranty	One year	One year
Safety	UL, CSA	ETL, CSA
CFG280 Counter Specifications		
Frequency Range (AC coupled)	–	1 Hz to 100 MHz
Sensitivity	–	30 mV RMS from 1 Hz to 50 MHz; 50 mV RMS from 50 MHz to 100 MHz:
Period Range/Resolution	–	1 ms to 60 s/1 ms
Crystal Frequency	–	10 MHz
Time Base Stability	–	±0.001% (±10 ppm) from 0° to 40°C
Frequency Accuracy	–	±(time base error + 1 count)
Period Accuracy	–	±(time base error + 1 count + trigger error)

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CFG253
3 MHz Function Generator.
Includes: Operator's Manual, US Power Cord, One Year Warranty.

CFG280
11 MHz Function Generator with 100 MHz Counter.
Includes: Operator's Manual, US Power Cord, One Year Warranty.

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

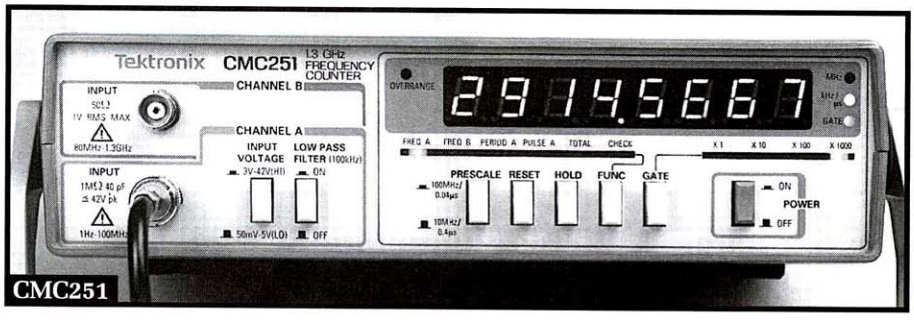
Tektronix Measurement products are manufactured in ISO registered facilities.

Counter
CMC251

Features

CMC251

- 1 Hz to 100 MHz (CH 1)
  80 MHz to 1.3 GHz (CH 2)
- ±1 ppm Time Base
- Period Average, Period, Frequency, Totalize Self-test
- Display Hold
- Remote Start/Stop



CMC251

CMC251

The CMC251 1.3 GHz Multifunction Counter measures the frequency of sine, square, and triangle waves from 1 Hz to 1.3 GHz. The CMC251 also provides period, totalize, and pulse width measurements. The counter has two input channels. Channel A is a standard 1 MΩ input for frequency measurements up to 100 MHz. Channel B is a 50 Ω terminated input for use in high-frequency systems. This counter is of interest to radio amateurs because of its ability to measure high-frequency systems. The temperature-compensated, crystal-controlled time base is stable to ±1 part per million per year.

Characteristics

CHANNEL A

Frequency Range – 1 Hz to 100 MHz.

Sensitivity – 20 mV RMS, 1 Hz to 30 MHz; 50 mV RMS, 30 MHz to 100 MHz.

Attenuation –
3 V to 42 V (HI); 50 mV to 5 V (LO).

Max. Input Voltage – 1 Hz to 5 MHz: 42 V pk; 5 MHz to 100 MHz: 4.9 V pk.

Low Pass Filter – –3 dB at 100 kHz.

Impedance – 1.0 MΩ, paralleled by 40 pF.

CHANNEL B

Frequency Range – 80 MHz to 1.3 GHz.

Sensitivity – 5 mV RMS, 80 MHz to 600 MHz; 15 mV RMS, 600 MHz to 900 MHz; 35 mV RMS, 900 MHz to 1.3 GHz.

Impedance – 50 Ω.

Max. Input Voltage – 1 V RMS.

PERIOD

Range – Direct: 0.4 µs to 1.0 s; Prescale: 0.04 µs to 1.0 s.

Resolution – Direct: 100 ps to 100 ns; Prescale: 10 ps to 10 ns.

Min. Pulse Width – Direct: 0.2 µs; Prescale: 20 ns.

Frequency Range – Direct: 1 Hz to 2.5 MHz; Prescale: 1 Hz to 25 MHz.

Events Averaged (N) – 1, 10, 100, 1000, 10,000 cycles.

Totalize Range – 0 to 99,999,999.

PULSE WIDTH

Range – 0.25 µs to 0.5 s.

Period Range – 100 ps to 100 ns.

Events Averaged (N) – 1, 10, 100, or 1000 cycles.

TIME BASE STABILITY

Temperature – <1 ppm from 0° to 40°C.

10% Line Voltage Change – <0.4 ppm.

ACCURACY

Frequency – ±(time base error + 1 count).

Period – ±(time base error + 1 count + trigger error).

Pulse Width – ±(time base error + 1 count + trigger error + 10 ns).

PLUS

Selectable Slope – No.

Ratio CH A: CH B – No.

Display Hold – Yes.

Remote Start/Stop – Yes.

Time Interval CH A: CH B – No.

Safety Certification – ETL, CSA.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CMC251
1.3 GHz Frequency Counter with High Stability Time Base.
Includes: Operator's Manual, US Power Cord, One Year Warranty.

AVAILABLE ACCESSORIES
10X Probe, 250 MHz. Order P6106A.

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

Digital Multimeters

New DMM910 Series • DMM916 • DMM914 • DMM912

Features

DMM916, DMM914, DMM912

- 40,000 Count Display
- 0.06% Basic DC Volts Accuracy (DMM916)
- Temperature Measurements from –50° C to +980° C (DMM916, DMM914)
- DC Voltage Ranges from 400 mV to 1,000 V
- AC Voltage Ranges from 4 V to 750 V (True RMS)
- AC and DC Current Ranges from 4,000 µA to 10 A
- Resistance Ranges from 400 Ω to 40 MΩ
- Capacitance Ranges from 4 nF to 40 mF
- Frequency Ranges from 400 Hz to 2 MHz
- 3 Year Warranty
- CE Marking

See also DMM150/200 Series

New DMM912/DMM914/DMM916

DMM916/DMM914/DMM912

The DMM910 series handheld digital multimeters from Tektronix are compact, battery-powered units with high measurement resolution and accuracy. Built-in safety features provide a high level of operator protection.

The three models share a common physical and operating format but vary in the features and accuracy. The DMM912 provides industry standard performance while the DMM914 and DMM916 provide unequaled accuracy and measurement features.

Each model includes a full complement of standard and optional accessories to meet any measurement challenge.

Key Features	DMM916	DMM914	DMM912
True RMS –	Yes	Yes	Yes
Auto Power Off (adjustable) –	Yes	Yes	Yes
Analog Bar Graph Display –	Yes	Yes	Yes
Auto Hold –	Yes	Yes	Yes
Autoranging with Manual Ranging –	Yes	Yes	Yes
Beep Guard –	Yes	Yes	Yes
Continuity Check/Beeper –	Yes	Yes	Yes
Diode Test –	Yes	Yes	Yes
Hold –	Yes	Yes	Yes
MIN/MAX/AVG/MAX-MIN –	Yes	Yes	Yes
Low-battery Indicator –	Yes	Yes	Yes
Overrange Indicator –	Yes	Yes	Yes
Delta Mode –	Yes	Yes	Yes
50/60 Hz Selection –	Yes	Yes	Yes
Auto Fuse Detection (beeper) –	Yes	Yes	Yes
Memory Store/Recall –	Yes	Yes	Yes
Center/Zoom Analog Bar Graph –	Yes	Yes	–
Delta Mode with Percent –	Yes	Yes	–
Duty Factor –	Yes	Yes	–

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Multimeters

New DMM910 Series • DMM916 • DMM914 • DMM912

Key Features (Continued)	DMM916	DMM914	DMM912
HI/LO Limits –	Yes	Yes	–
Time Stamp for MIN/MAX/AVG –	Yes	Yes	–
VAC/Hz and AAC/Hz Dual Display –	Yes	Yes	–
Temperature Feature	Yes	Yes	–
Peak Hold (1 ms) –	Yes	–	–
Backlight (auto-off adjustable) –	Yes	–	–
dBm and dB Readings –	Yes	–	–
Safety – IEC, UL, CSA	Yes	Yes	Yes
Warranty – Three years	Yes	Yes	Yes

CHARACTERISTICS

	DMM916	DMM914	DMM912
Display Range (selectable)	40,000 and 4,000	40,000 and 4,000	40,000 and 4,000
Display Update Rate (selectable)	1/s to 4/s	1/s to 4/s	1/s to 4/s
Analog Bar Graph Update Rate	20/s	20/s	20/s
DC Voltage Ranges (full scale)	400.00 mV, 4.0000 V, 40.000 V, 400.00 V, 1,000.0 V	400.00 mV, 4.0000 V, 40.000 V, 400.00 V, 1,000.0 V	400.00 mV, 4.0000 V, 40.000 V, 400.00 V, 1,000.0 V
– Best accuracy	0.06%	0.10%	0.20%
AC Voltage Ranges, RMS (full scale)	4.0000 V, 40.000 V, 400.00 V, 750.0 V	4.0000 V, 40.000 V, 400.00 V, 750.0 V	4.0000 V, 40.000 V, 400.00 V, 750.0 V
– Best accuracy	0.70%	0.80%	1.00%
– Crest factor	3	3	3
DC Current Ranges (full scale)	4,000.0 µA, 400.00 mA, 10.000 A	4,000.0 µA, 400.00 mA, 10.000 A	4,000.0 µA, 400.00 mA, 10.000 A
– Best accuracy	0.30%	0.40%	0.50%
AC Current Ranges (full scale)	4,000.0 µA, 400.00 mA, 10.000 A	4,000.0 µA, 400.00 mA, 10.000 A	4,000.0 µA, 400.00 mA, 10.000 A
– Best accuracy	0.90%	0.90%	1.20%
Resistance Ranges (full scale)	400.00 Ω, 4.0000 kΩ, 40.000 kΩ, 400.00 kΩ, 4.0000 MΩ, 40.000 MΩ	400.00 Ω, 4.0000 kΩ, 40.000 kΩ, 400.00 kΩ, 4.0000 MΩ, 40.000 MΩ	400.00 Ω, 4.0000 kΩ, 40.000 kΩ, 400.00 kΩ, 4.0000 MΩ, 40.000 MΩ
– Best accuracy	0.30%	0.40%	0.50%
Low-Voltage Ω Ranges (full scale)	4.000 kΩ, 40.00 kΩ, 400.0 kΩ, 4.000 MΩ, 40.00 MΩ	4.000 kΩ, 40.00 kΩ, 400.0 kΩ, 4.000 MΩ, 40.00 MΩ	4.000 kΩ, 40.00 kΩ, 400.0 kΩ, 4.000 MΩ, 40.00 MΩ
– Best accuracy	0.60%	0.80%	1.00%
Capacitance Ranges (full scale)	4.000 nF, 40.00 nF, 400.0 nF, 4.000 µF, 40.00 µF, 400.0 µF, 4.000 mF, 40.00 mF	4.000 nF, 40.00 nF, 400.0 nF, 4.000 µF, 40.00 µF, 400.0 µF, 4.000 mF, 40.00 mF	4.000 nF, 40.00 nF, 400.0 nF, 4.000 µF, 40.00 µF, 400.0 µF, 4.000 mF, 40.00 mF
– Best accuracy	1.00%	1.00%	1.00%
Frequency Ranges (full scale)	400.00 Hz, 4.0000 kHz, 40.000 kHz, 400.00 kHz, 2.0000 MHz	400.00 Hz, 4.0000 kHz, 40.000 kHz, 400.00 kHz, 2.0000 MHz	400.00 Hz, 4.0000 kHz, 40.000 kHz, 400.00 kHz, 2.0000 MHz
– Best accuracy	0.01%	0.01%	0.01%
Temperature Range	–50° C to +980° C	–50° C to +980° C	–
– Best accuracy (K-type)	2° C	2° C	–

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DMM916, DMM914, DMM912
Handheld Digital Multimeter.
Includes: 9 V Battery, User Manual (070-9791-00), Boot, ATL01 Test Leads.

Warranty – Three years.

Opt. 96 – Certificate of Calibration.

Opt. 1L – Substitute Asian Languages Manual (070-9792-00).

RECOMMENDED ACCESSORIES

A605 – 500 A AC Current Probe.

A610 – 500 A AC/DC Current Probe.

ATLDX1 – Deluxe Lead Set w/Tip Accessories.

ATL21 – Shielded Banana Plug Leads.

ATL22 – Plug-on Test Lead Tips.

ATL23 – Plug-on Sharp 'IC' Test Lead Tips.

ACL21 – Plug-on Safety Alligator Clips.

ACL22 – Plug-on Hook-tip Clips.

ACL23 – Plug-on Wire Clamp Clips.

ACL24 – Plug-on Jaw Clips.

AC12 – Large Nylon Soft Case.

AC13 – Long Nylon Soft Case.

ATP01 – K-type Bead Probe for Temperature Measurements (ATK01 Thermocouple-to-Banana Plug Adapter required for use with DMM900s).

TEKTRONIX MEASUREMENT SERVICE
Tektronix CAL and REP Service programs allow you to pre-purchase genuine Return to Tektronix Services – ask your Distributor for details.

Digital Multimeters

CMM150 • DMM150 • DMM157 • DMM249 • DMM254

Features

DMM150/CMM150
- Autoranging
- Analog Bar Graph
- 3,200 Counts Display
- 0.7% Basic Accuracy
- Voltage and Resistance Measurement
- Current Measurement with CMM150

DMM157
- Autoranging
- Analog Bar Graph
- 3200 Counts Display
- 0.5% Basic Accuracy
- Voltage and Resistance Measurement
- Current and Capacitance Measurement

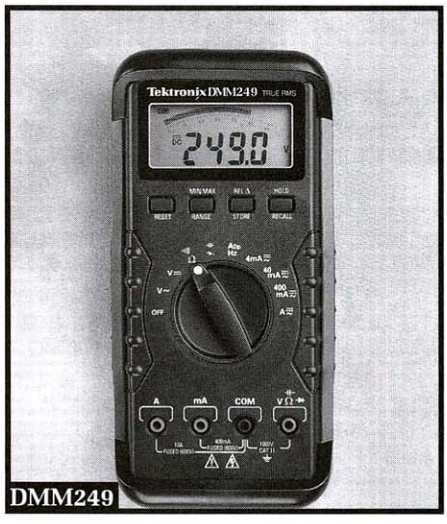
DMM249
- Autoranging
- Analog Bar Graph
- True RMS Measurement
- 3,200 Count Autoranging
- 0.3% Basic Accuracy
- Voltage, Resistance
- AC/DC Current

DMM254
- Autoranging
- Analog Bar Graph
- True RMS Measurement
- 4,000 Count Autoranging
- 0.1% Basic Accuracy
- Voltage, Resistance
- Frequency Measurement
- Capacitance Test
- AC/DC Current

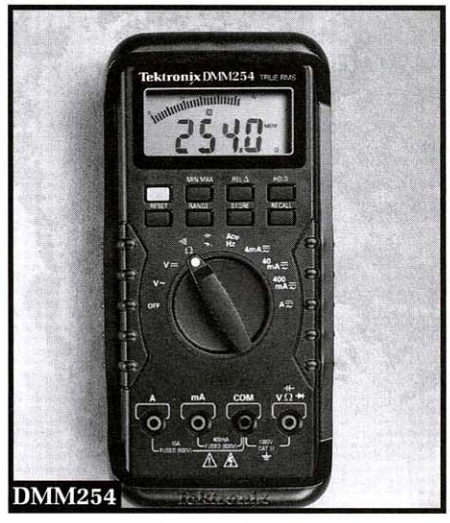
CMM150/DMM150/DMM157

DMM150/CMM150
The DMM150 is great for one-handed operation and measurements in tight places. With the optional CMM150 Clamp Probe, it also measures AC current. See page 419 for characteristics.

DMM157
The DMM157 is ideal for the service technician or student who needs a rugged, multifunction product with good accuracy at a reasonable price. See page 419 for characteristics.



DMM249



DMM254

DMM249
The DMM249 is a rugged state-of-the-art meter enclosed in dust and water resistant cases. The DMM249 also provides True RMS measurement function. See page 419 for characteristics.

DMM254
The DMM254 is designed for the professional who needs full function capabilities with exceptional accuracy. The DMM254 also provides True RMS measurement functions. See page 419 for characteristics.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Multimeters

CMM150 • DMM150 • DMM157 • DMM249 • DMM254

KEY SPECIFICATIONS

	CMM150/DMM150	DMM157	DMM249	DMM254
Basic DC Volts Accuracy	0.7%	0.5%	0.3%	0.1%
AC Voltage Ranges	3 V to 600 V	3 V to 600 V	3 V to 750 V	400 mV to 750 V
DC Voltage Ranges	300 mV to 600 V	300 mV to 600 V	300 mV to 1000 V	400 mV to 1000 V
True RMS AC	–	–	Yes	Yes
AC Current Ranges	300 A max. (CMM150)	300 µA to 10 A	300 µA to 20 A	4 mA to 10 A
DC Current Ranges	–	300 µA to 10 A	300 µA to 20 A	4 mA to 10 A
Resistance Ranges	300 Ω to 30 MΩ	300 Ω to 30 MΩ	300 Ω to 30 MΩ	400 Ω to 40 MΩ
Capacitance Ranges	–	3 µF to 3000 µF	–	4 nF to 40 µF
Frequency Ranges	–	–	–	100 Hz to 1 MHz
Display Resolution	3200 counts	3200 counts	3200 counts	4000 counts
Features				
Analog Display	Yes	Yes	Yes	Yes
Auto Power Off	Yes	Yes	Yes	Yes
Autoranging	Yes	Yes	Yes	Yes
Delta Offset Mode	–	–	–	Yes
Continuity Check/Beeper	Yes	Yes	Yes	Yes
Data Hold	Yes	Yes	Yes (and Delay Hold)	Yes
Diode Test	Yes	Yes	Yes	Yes
Low Battery Indicator	Yes	Yes	Yes	Yes
Overrange Indication	Yes	Yes	Yes	Yes
Safety Certification	IEC, UL, CSA	IEC, UL, CSA	IEC, UL, CSA	IEC, UL, CSA
Water-resistant Case	–	–	Yes	Yes

Digital Multimeters

CMM150 • DMM150 • DMM157 • DMM249 • DMM254

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DMM150
Pen Meter.
Includes: Test Leads, 2AAA Batteries, User Manual.

CMM150
AC Clamp Probe.

DMM157
Handheld Digital Multimeter.
Includes: Test Leads, 2 AAA Batteries, User Manual, Holster.

DMM249/DMM254
Handheld Digital Multimeter.

Both Include: Test Leads, 9 V Battery, User Manual, Holster.

Warranty – Three years.

RECOMMENDED ACCESSORIES

DMM249/254 –
Fuses – Fast Blow.
1 A/600 V. Order 159-0337-00.
15 A/600 V. Order 159-0287-00.

DMM157 –
Fuses – 240 V-13A. Order 159-0357-00.
240 V 1A. Order 159-0355-00.

A605 – 500 A AC Current Probe.

A610 – 500 A AC/DC Current Probe.

ATLDX1 – Deluxe Lead Set w/Tip Accessories.

ATL21 – Shielded Banana Plug Leads.

ATL22 – Plug-on Test Lead Tips.

ATL23 – Plug-on Sharp 'IC' Test Lead Tips.

ACL21 – Plug-on Safety Alligator Clips.

ACL22 – Plug-on Hook-tip Clips.

ACL23 – Plug-on Wire Clamp Clips.

ACL24 – Plug-on Jaw Clips.

AC12 – Large Nylon Soft Case.

AC13 – Long Nylon Soft Case.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Thermometers

New DTM900 Series • DTM920 • DTM900

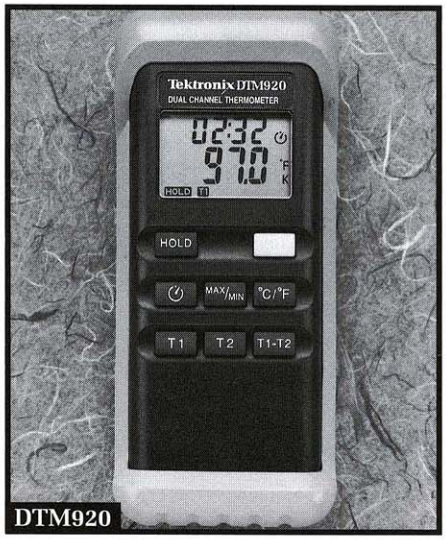
Features

DTM920

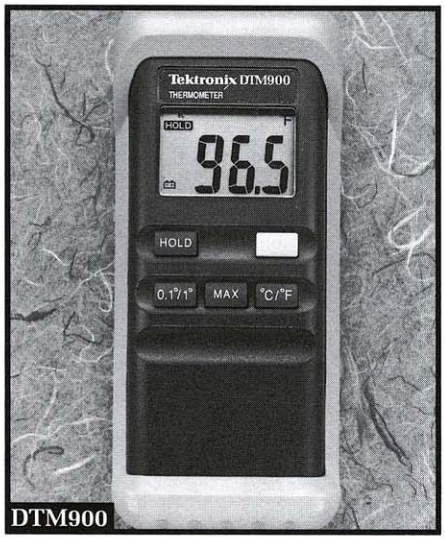
- Dual-channel Temperature Measurements
- Differential Temperature Measurements
- –200° C to +1,370° C Temperature Range
- 3 Year Warranty

DTM900

- –50° C to +1,300° C Temperature Range
- 3 Year Warranty



DTM920



DTM900

DTM920

The DTM920 offers two-channel and differential temperature measurements over a wide temperature range with better accuracy.

DTM900

The DTM900 series digital thermometers from Tektronix are compact, battery-powered units. The DTM900 offers basic, easy-to-use temperature measurement.

CHARACTERISTICS

	DTM920*1	DTM900*1
Channels	2	1
Thermocouples	J or K	K
Accuracy		
Single Input	±(0.1% + 0.7° C)	±(0.3% + 1° C)
T1 – T2	±(0.1% + 2° C)	–
Resolution (° C)	0.1/1	0.1/1
Minimum Temperature	–200° C	–50° C
Maximum Temperature	+1,370° C	+1,300° C
Measurement Hold	Yes	Yes
Record Maximum	Yes	Yes
Record Minimum	Yes	–
Differential (T1 – T2)	Yes	–
Auto Ranging	Yes	–
Stop Watch	Yes	–
Dimensions (including holster)		
Length	170 mm (6.7 in.)	170 mm (6.7 in.)
Width	74 mm (2.9 in.)	74 mm (2.9 in.)
Depth	39 mm (1.5 in.)	39 mm (1.5 in.)
Warranty	3 years	3 years

**1 All characteristics are for the temperature meter only and do not include the temperature probe.*

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DTM920
Digital Thermometer (Dual Channel).
Includes: 9 V Battery, User Manual (070-9692-00), Holster, Two ATP01 Bead Probe.

DTM900
Digital Thermometer.
Includes: 9 V Battery, User Manual (070-9692-00), Holster, ATP01 Bead Probe.

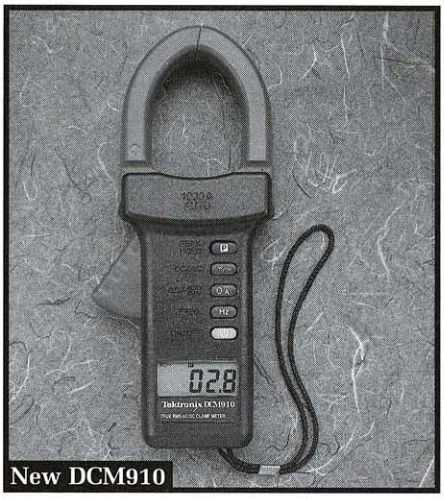
RECOMMENDED ACCESSORIES
AC11 – Small Nylon Soft Case.
Warranty – Three years.

Digital Clamp Meter
New DCM910

Features

NEW DCM910

- 4000 Count Display
- Measure AC Current, DC Current, and Frequency
- True RMS
- 3 Year Warranty
- CE Marking



New DCM910

DCM910

The DCM910 Digital Clamp Meter is a battery-powered current meter from Tektronix. Built-in safety features provide a high level of operator protection.

The DCM910 enables users to measure true RMS AC and DC currents without breaking the circuit under test. The DCM910 also provides frequency measurement capability for quick characterization of AC signals.

Characteristics

Digital Display Range – 4000.

AC Current Ranges – 400 A and 1000 A.
– Best accuracy – 1.9%.
– Frequency – 40 – 400 Hz.

DC Current Ranges – 400 A and 1000 A.
– Best accuracy – 1.9%.

Crest Factor – Up to 3.

Frequency Ranges – 4 kHz and 10 kHz.
– Best accuracy – 0.5%.

Jaw Size (diameter) – 51 mm.

Transducer – Hall Effect.

Key Features

True RMS

Auto Power Off (adjustable)

Autoranging

Low-battery Indicator

Hand Guard Designed

Peak Hold

Auto Zero (DCA)

Safety – IEC, UL, CSA.

Warranty – 3 years.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DCM910
Digital Clamp Meter.
Includes: 9 V Battery, User Manual (070-9696-00), AC13 Soft Case.
Warranty – Three years.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix Representative for a full list of service options.

Handheld Accessories

Current Probes

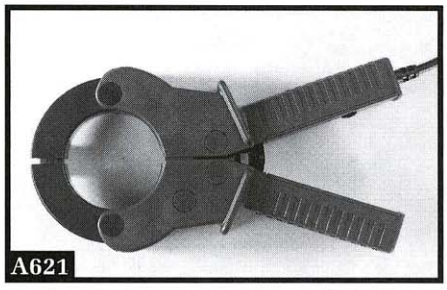
CURRENT PROBES FOR ANY DMM OR OSCILLOSCOPE

- Clamp-on
- Excellent Value
- AC and DC
- Easy to Use

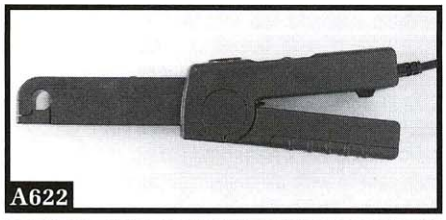
The A600 Series current probes high-value current probes are specifically designed to support measurements you make with your DMM, TekMeter® or oscilloscope.

A605 500 AMP AC CURRENT PROBE
This "busbar" style clamp-on probe is a current/voltage transformer for digital multimeters and TekMeter®. The A605 can measure RMS AC currents ≥4 A and peak currents up to 500 A over as frequency range of 48 Hz to 1kHz. It provides a 1 mV output for each Amp measured.

A610 500 AMP AC/DC CURRENT PROBE
This "busbar" style clamp-on probe uses a Hall Effect current sensor to provide a voltage output to digital multimeters. The A610 can measure RMS AC currents ≥2 A and peak currents up to 500 A over a frequency range of DC to 440 Hz. It provides a 1 mV output for each Amp measured.



A621 2000 AMP AC CURRENT PROBE/BNC
This industrial style clamp-on probe has a BNC connector and a shrouded banana plug adapter so it can be used on digital multimeters, TekMeter, and scopes. The A621 can measure AC currents from 100 mA to 2000 A peak over a frequency range of 5 Hz to 50 kHz. It provides a 1 mV, 10 mV, or 100 mV output for each Amp measured.



A622 100 AMP AC/DC CURRENT PROBE/BNC
This "long nose" style clamp-on probe uses a Hall Effect current sensor to provide a voltage output to oscilloscopes. It has a BNC connector and a shrouded banana plug adapter so it can also be used on digital multimeters, TekMeter and scopes. The A622 can measure AC/DC currents from 50 mA to 100 A peak over a frequency range of DC to 100 kHz. It provides 10 mV or 100 mV output for each Amp measured.

Model Number	Frequency Range	Current Range RMS to Peak	Application	Max. Conductor	Termination
A605	48 Hz to 1 kHz	4 A to 500 A	DMM/TekMeter	30 mm dia.	Shielded Banana Plug
A610	DC to 440 Hz	2 A to 500 A	DMM/TekMeter	30 mm dia.	Shielded Banana Plug
A621	5 Hz to 50 kHz	100 mA to 2,000 A	Scope/DMM/TekMeter	54 mm dia.	BNC (w/banana adapter)
A622	DC to 100 kHz	50 mA to 100 A	Scope/DMM/TekMeter	11.8 mm dia.	BNC (w/banana adapter)

TEST LEAD AND PROBE COMPATIBILITY CHART

Part #	Description	DMM100 Series	DMM200 Series	DMM910 Series	THS700 Series
A605	AC Current Probe, 500A	Yes	Yes	Yes	Yes
A610	AC/DC Current Probe, 500A	Yes	Yes	Yes	Yes
A621	AC Current Probe, 2000A	Yes	Yes	Yes	Yes
A622	AC/DC Current Probe, 100A	Yes	Yes	Yes	Yes

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

A605
500 A AC Current Probe.

A610
500 A AC/DC Current Probe.

A621
2000 A AC Current Probe/BNC.

A622
100 A AC/DC Current Probe/BNC.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

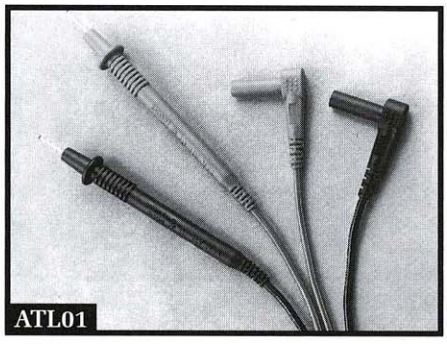
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

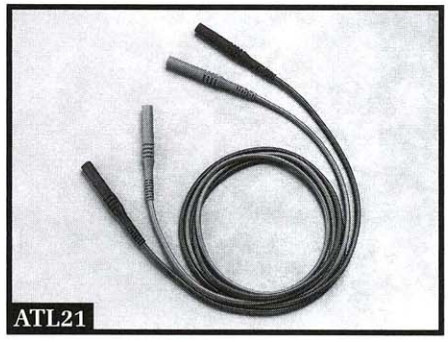
Handheld Accessories

Test Leads and Clips

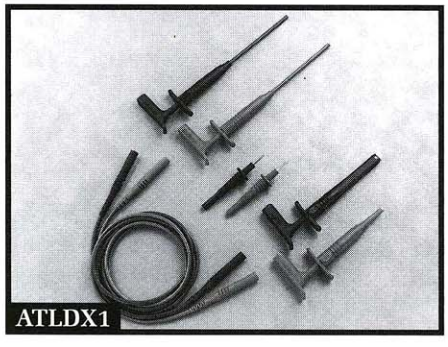
Making a proper test connection is extremely important to safe, accurate measurements. Tektronix full range of leads, clips and probes give you confidence that you have the most dependable test connections for your application. Tektronix handheld accessories are compatible with all meters accepting safety-shrouded, standard-size banana plugs.



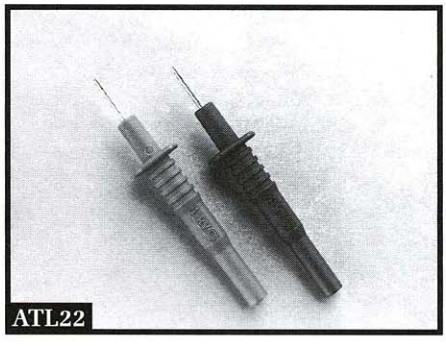
ATL01 Basic Lead Set – The standard test lead sets shipped with all DMM 900 Series meters. Compatible with all DMMs that accept safety-shrouded, standard-size banana plugs. One red lead and one black lead rated at 1000 V, 10 A per IEC 1010, category III. UL1244 listed.



ATL21 Shielded Banana Plug Lead Cables – UL1244 approved 1000V, 10 A. Basic building block for the following test lead components. Rugged silicone maintains flexibility and operability over a wide temperature range. One red and one black. The safety-shrouded standard-sized banana plugs are compatible with all DMMs. IEC 1010, category II.



ATLDX1 Deluxe Lead Set – A complete set of test leads and clips to cover most Applications. Includes two ATL21 high-temperature, silicone test leads, two ATL22 test lead tips, one red ACL22 hook-tip clip, two ACL23 wire clips and one black ACL24 jaw clip. UL1244 approved 1000 V, 10 A. The safety-shrouded standard-sized banana plugs are compatible with all DMMs. IEC 1010, category II.



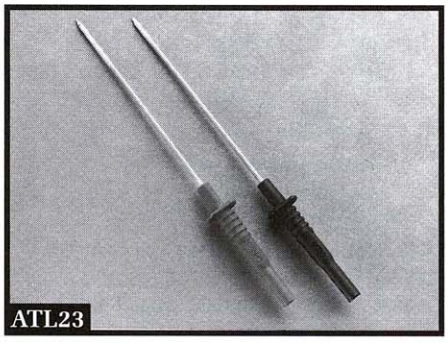
ATL22 Standard Test Lead Tips – One red and one black test lead tip with safety-shrouded banana plug connection to the ATL21 Lead Cables UL1244 approved 1000 V, 10 A. IEC 1010, category II.

TEST LEAD AND PROBE COMPATIBILITY CHART

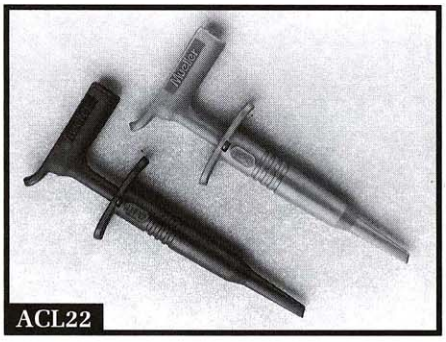
Part #	Description	DMM100 Series	DMM200 Series	DMM910 Series	THS700 Series
ATLDX1	Deluxe Lead Set	Yes	Yes	Yes	Yes
ATL01	Basic Lead Set w/ Probe Tips	Yes	Yes	Yes	Yes
ATL21	Basic Test Leads	Yes	Yes	Yes	Yes
ATL22	Basic Tip	Yes	Yes	Yes	
ATL23	Extended Reach Tip	Yes	Yes	Yes	Yes
ACL21	Alligator Clips	Yes	Yes	Yes	Yes
ACL22	Hook Clips	Yes	Yes	Yes	
ACL23	Wire Clips	Yes	Yes	Yes	
ACL24	Jaw Clips	Yes	Yes	Yes	

Handheld Accessories

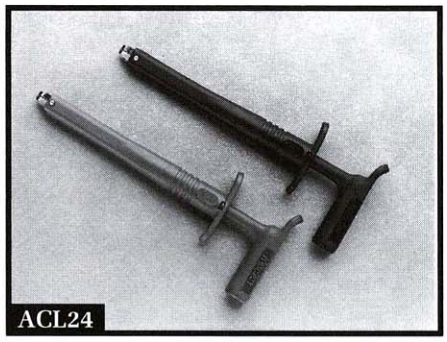
Test Leads and Clips



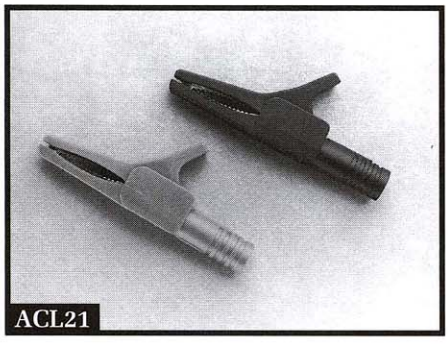
ATL23 Extended Test Lead Tips – One red and one black test lead tip with safety-shrouded banana plug connection to the ATL21 Lead Cables. UL1244 approved 1000 V, 10 A. IEC 1010, category II.



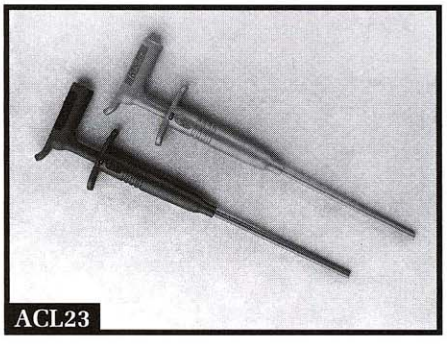
ACL22 Hook-Tip Clips – One red and one black clip with BeCu hooks for solid electrical contact to most test points. Have safety-shrouded banana plug connection to the ATL21 Lead Cables. UL1244 approved 1000 V, 10 A. IEC 1010, category II.



ACL24 Jaw Clips – One red and one black clip for solid electrical connection to thick wires, ground leads, cable and rails for hands-off measurements. Have safety-shrouded banana plug connection to the ATL21 Lead Cables. UL1244 approved 1000 V, 10 A. IEC 1010, category II.



ACL21 Large Alligator Clips – One red and one black clip designed for safe safety. These durable clips provide positive electrical contact while protecting the user from electrical shock. Have safety-shrouded banana plug connection to the ATL21 Lead Cables. UL1244 approved 1000 V, 10 A. IEC 1010, category II.



ACL23 Wire Clips – One red and one black clip assures positive electrical connection to your most delicate test points. Safety-shrouded banana plug connection compatible with the ATL21 Lead Cables. UL1244 approved 1000 V, 10 A. IEC 1010, category II.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ATL01
Basic Lead Set.

ATLDX1
Deluxe Lead Set.

ATL21
Shielded Banana Plug Lead Cables.

ATL22
Standard Test Lead Tips.

ATL23
Extended Test Lead Tips

ACL21
Large Alligator Clips.

ACL22
Hook–Tip Clips.

ACL23
Wire Clips.

ACL24
Jaw Clips.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

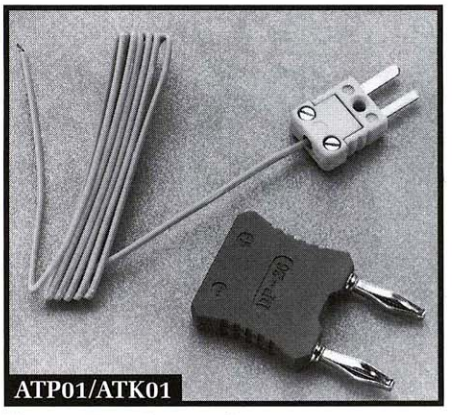
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Handheld Accessories

Temperature • Carrying Cases



Temperature Accessories.

Soft Carrying Cases.

ATK01 Temperature Probe Adapter – Thermocouple to banana plug adapter allows use of any type K thermocouple probe to be used with DMM914/916 instrument.

ATP01 Bead Probe – Type K thermocouple. For all general purpose temperature measurements (not liquid immersion). –40 to 204°C. (DMM 914/916, DTM 900).

AC11 Small DMM Soft Case – For any DMM 100/200 Series instrument with ample room for accessories and manual. Rugged tear-resistant material is lined with foam for extra shock protection.

AC12 Large DMM Soft Case – For any DMM 910 Series instrument with ample room for accessories and manual. Rugged tear-resistant material is lined with foam for extra shock protection.

AC13 Long DMM Soft Case – For any DMM 200, 910 Series instrument with ample room for accessories and manual. Rugged tear-resistant material is lined with foam for extra shock protection.

TEST LEAD AND PROBE COMPATIBILITY CHART

Part #	Description	DMM100 Series	DMM200 Series	DMM910 Series	THS700 Series
AC11	Small Soft Case	Yes	Yes		
AC12	Large Soft Case			Yes	
AC13	Long Soft Case	Yes	Yes	Yes	
ATK01	Thermocouple Adapter			Yes	
ATP01	Basic Temperature Probe			Yes	

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ATK01
Temperature Probe Adapter.

ATP01
Bead Probe.

AC11
Small DMM Soft Case.

AC12
Large DMM Soft Case.

AC13
Long DMM Soft Case.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Handheld Accessories

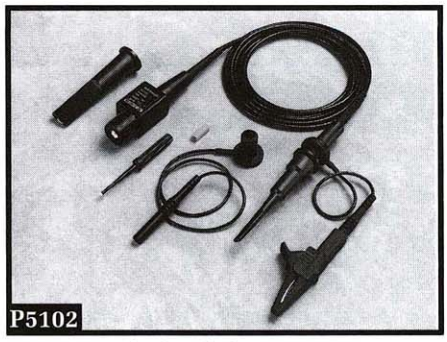
THS700 Oscilloscope Probes • Battery Charger • Hardcase

PROBES FOR THE THS700 SERIES
Passive Voltage Probes Standard with the THS700 Series

BATTERY CHARGER
THS7CHG – Ni-Cad Fast Charging Unit

HARD CARRYING CASE
THS7HCA

P6117 Standard with the THS710A, THS720A and THS730A



P5102 Standard with the THS720P.

Probe	Cable Length	Bandwidth	Attenuation	Comp. Range	Input C	System Input Resistance	Maximum Input	Scopes
P6117*[1]	2 m	200 MHz	10X	15 to 35 pF	13.3 pF	10.0 MΩ	300 V RMS	THS710A/720A/730A
P5102*[1]	2 m	100 MHz	10X	24 to 28 pF	11.2 pF	5.0 MΩ	1000 V RMS	THS720P (only)

[1] Both of these probes can be used with any of the THS700 Series Scopes. This only designates that these probes come standard with the scopes listed.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6117
10X, 200 MHz Standard Probe for THS710A/720A/730A.

P5102
10X, High Voltage Probe for THS700 Series.

THS7CHG
Battery Charger.

THS7HCA
Hard Carrying Case.

Product(s) available through your local Tektronix Distributor listed in the back of this catalog.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Measurement
Education

Features

LEARNING MATERIALS

Tektronix Learning Materials Are:

- Written by Educators and Instructional Designers
- Professionally Produced
- Comprehensive, Covering Both Operations and Concepts
- Designed for Beginning Through Advanced Students
- Available in Videotapes, Workbooks, Instructors Guides, QuickStart™, and Self-study Packages

A Partnership Dedicated to Educational Excellence

As an educator, you play a key role in shaping the future of business and technology; you're committed to helping emerging technicians, scientists, and engineers learn skills they'll apply for years to come.

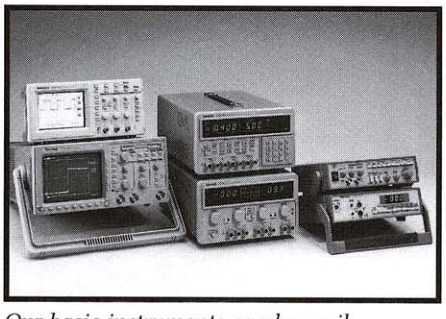
Tektronix products have long been the products of choice for educational institutions around the world because they:

- Are easy to learn and use
- Meet stringent testing standards
- Are rugged, student-proof and safe
- Are the same high quality instruments used in industry
- Provide a smooth transition from school to career

THE LONG TERM CHOICE

Tektronix' commitment to education does not end with the purchase of equipment. Our long term commitment to education is demonstrated by the availability of:

- Courseware and instructional materials
- Rugged and safe equipment
- Operator and technician training
- Extended warranties



Our basic instruments can be easily stacked and conserve bench space. They complement our analog and digital oscilloscopes as a popular setup for basic lab stations.

BUDGET SOLUTIONS

At Tektronix we understand the dilemma that many educators face – you have a need for industry-proven, up-to-date equipment, but your budgets don't always allow for funding. Therefore, we offer a line of low-cost basic electronics equipment through our distributors that meets the needs of both education and industry. You'll also be pleased to know that Tektronix offers special pricing for educational institutions.

We are working to meet your educational objectives – providing technologically advanced products, budget alternatives, and superior quality and service.

RUGGED AND SAFE

In both design and test, we ensure that our products meet stringent standards for EMI, humidity, temperature, electrostatic shock, and vibration. Tektronix products are also third-party certified by UL and CSA. Not only do these certifications protect you and your students, they help you comply with many state and local regulations.

A BROAD RANGE OF PRODUCTS

Tektronix offers the best selection of test and measurement equipment in the industry. Whether you're buying for a vocational center, community college or major university, you'll find we have everything you need.

The Tektronix measurement products include:

- Analog and Digital Oscilloscopes
- Logic Analyzers, Spectrum Analyzers
- Function Generators, Power Supplies, Counters
- Automatic stimulus and measurements tools
- Modular instruments for custom systems
- A full line of accessories

From basic to advanced laboratory and bench instrumentation, our products will meet your needs in:

- Electronics
- Mechanical Engineering
- Physics
- Semi- and fully-automated test

And in every Tektronix product you'll find the familiar, easy operation that's become a de facto standard the world over, which is perhaps the main reason why people in so many different environments prefer Tektronix equipment.

Because whether your students are preparing to seek their fortunes, or preparing to apply what they've learned to make it, there's no substitute for the confidence that comes from using the best: Tektronix.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Measurement
Education

Courseware and Training

For many instructors, the time spent preparing to teach far outweighs the time spent teaching. That's why we offer comprehensive and self-contained courseware. This courseware is designed to complement and supplement the broad range of Tektronix' test and measurement products and your classroom curriculum.

SELF-STUDY PACKAGES

Realizing the need for individuals to learn at their own pace, Tektronix has developed an extensive line of self-study packages. Engineers as well as students can sharpen their skills in instrument usage and application in less time than learning by trial and error.

In less than an hour, the student can learn the unique time-saving features of the equipment and put these to use immediately. The result is increased productivity.

To conserve valuable lab time, Tektronix has created these aids so that students can come prepared to apply their understanding of the equipment to the challenges of the curriculum.

Each self-study course includes a detailed video instruction tape and a workbook. Materials cover instrument operations as well as concepts and applications, from basic through advanced test and measurement techniques. Discussions include:

- Basic Instrument Concepts
- Major Product Features and Operation
- Applications
- Probe Compensation and Usage
- Measurement Techniques
- Controller Integration
- Communication Interfaces
- Display and Output Concepts

QUICKSTART PACKAGES

These specially designed packages provide detailed hands-on instruction and application examples. Each package provides step-by-step workbooks and specially designed signal generation boards to help the user get up and running in no time at all. These packages are designed for self-paced use or for integration into the classroom curriculum.

Tektronix' extensive selection of learning materials can save you countless hours in the preparation and presentation processes so that you can concentrate on what you do best – educating our next generation of engineers and technicians.

VIDEOTAPE AND LITERATURE

Tektronix offers educators one of the most extensive libraries of videotaped presentations on theory and application in the industry. And for classroom and lab work, Tektronix' primers and workbooks take students from the most basic level of skills through the highest levels of sophistication they'll need for a successful career.

SERVICE AND SUPPORT ALSO KEY

Tektronix' highly trained account managers, application engineers and distributors stand ready to offer you both curriculum and technical support. Our curriculum support materials and workshops will help you keep up to date. Also, we offer standard warranties as well as a variety of service programs to keep your Tektronix equipment calibrated and in the best working condition.

To complement the warranty programs, Tektronix has service centers conveniently located around the U.S. and throughout the world. You will want to take advantage of our service network because we can provide the expertise needed to calibrate and maintain your instruments at their highest level of performance.

"We are pleased to say that in our Industrial Electronics training program we are still successfully using Tektronix test equipment that was purchased 16 years ago. The wearability and quality of the equipment is noteworthy because we utilize the equipment on a daily basis in the instruction and training of our students. We spend little time on repairs and are very satisfied with the technical support and service offered through Tektronix."

Gene Prigmore
Industrial Electronics Instructor
Moore-Norman Vo-Tech Center
Norman, Oklahoma

Measurement
Education

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

VIDEOTAPE SELECTION GUIDE
Note: "XX" is to be replaced by one of the following:
NTSC format (used in USA)
00 = 3/4 in., **01** = BETA I, **02** = BETA II, **03** = BETA III, **04** = VHS/NTSC.

PAL format
06 = VHS/PAL, **08** = Workbooks.

SECAM format
07 = VHS/SECAM.

SELF-STUDY PACKAGES
Each self-study course includes a detailed video instruction tape and a workbook. Additional workbooks are available.

Fundamentals of Analog Scopes 068-0270-XX.

Fundamentals of Probes 068-0269-XX.

Fundamentals of Digital Scopes 068-0268-XX.

Fundamentals of GPIB 068-0260-XX.

Fundamentals of RS232 068-0259-XX.

Using the PC as a Controller 068-0301-XX.

Fundamentals of Logic Analyzers 068-0291-XX.

Operating the 2201 068-0290-XX.

Operating the 2205 068-0289-XX.

Operating the 2210 068-0274-XX.

Operating the 2211 068-0311-XX.

Operating the 2213A/2215A 068-0278-XX.

Operating the 2220 068-0273-XX.

Operating the 2221 068-0272-XX.

Operating the 2224 068-0310-XX.

Operating the 2225 068-0279-XX.

Operating the 2230 068-0271-XX.

Operating the 2232 068-0312-XX.

Operating the 2235 068-0277-XX.

Operating the 2236 068-0276-XX.

Operating the 2245A 068-0325-XX.

Operating the 2246A 068-0326-XX.

Operating the 2247A 068-0327-XX.

Operating the 2430A 068-0267-XX.

Operating the 2432 068-0266-XX.

Operating the 2432A 068-0305-XX.

Operating the 2440 068-0265-XX.

Operating the 2445A/2465A 068-0262-XX.

Operating the 2445B/2465B/2467B 068-0261-XX.

Operating the 11301A/11302A 068-0264-XX.

11301/11302 Waveform Measurement 068-0304-XX.

11401/11402 Waveform Measurement 068-0302-XX.

11401/11402 Adv. Waveform Measurement 068-0303-XX.

Operating the 1230 068-0288-XX.

QUICKSTART™ PACKAGES
Each package is designed to give step-by-step instruction using workbooks and specially designed signal generation boards.

TDS500/600 QuickStart Package 020-2024-00 (U.S.), 020-2025-00 (European).

2240 Series QuickStart Package*1 020-1864-04 (VHS/NTSC), 020-1864-06 (VHS/PAL).

GPX QuickStart Package 020-2093-00.

2211 DSO QuickStart Package*1 020-1811-04 (VHS/NTSC), 020-1811-06 (VHS/PAL).

2400 Series Digital Oscilloscopes QuickStart Package*1 020-1679-00 U.S. power (VHS/NTSC), 020-1681-00 European power (VHS/PAL).

11402/11403 QuickStart Package 020-1767-01 (U.S.), 020-1768-01 (European).

DSA 600 QuickStart Package 020-1769-00 (U.S.), 020-1770-00 (European).

2252/2247A/2245A QuickStart Package*1 020-1864-04 (VHS/NTSC), 020-1864-06 (VHS/PAL).

2232/2224/2221A QuickStart Package*1 020-1812-04 (VHS/NTSC), 020-1812-06 (VHS/PAL).

VIDEOTAPES

Oscillo-what? What Is an Oscilloscope? Discusses the display, vertical, horizontal and trigger sections and introduces digitizing oscilloscopes. 068-0218-XX.

Oscilloscope Primer Practical Scope How to use a scope, acquire a trace, select suitable vertical and horizontal scale factors, and how to use the special features on the Tektronix 2225 Oscilloscope. 068-0227-XX.

The Vital Link – Probe and Signal Concepts 068-0229-XX. See page 439 for full description.

Fundamentals of Oscilloscopes: A Functional Overview For people with prior electronics knowledge and some exposure to oscilloscopes. Explains functional characteristics of a typical analog oscilloscope. 068-0217-XX.

Fundamentals of Oscilloscopes: Digital Storage Concepts Describes and illustrates functional concepts of typical digital storage oscilloscope. 068-0240-XX.

222 Family Operation Overview of oscilloscope operation and a detailed front panel tour of the 222 Family. 068-0344-XX.

Understanding Spectrum Analyzers Highlights differences between time and frequency domain displays. Examines real time and swept super heterodyne spectrum analyzers. Demonstrates basic controls and functions. 068-0350-XX.

Soldering FlexLead™ Adapters 068-0320-04 (VHS/NTSC), 068-0320-06 (VHS/PAL), 068-0320-07 (VHS/SECAM).

Networking 101 – Ethernet Networking Made Simple Describes Ethernet from its hardware perspective. Demonstrates how Ethernet works. Illustrates common Ethernet building blocks. 068-0345-XX.

Networking 102 – TCP/IP Explains basics of TCP/IP addressing the three classes of networks, use of netmasks to create subnets, how TCP/IP/Ethernet addressing work together to move data across networks, use of a default gateway to move data between networks. 068-0347-XX.

Networking 103 – Token-ring Discusses Token-ring Computer networks. Explores the similarities and differences with Ethernet. Explains source routing, MAUs, Cabling and LAN speed. Third in a series of Networking videotapes. 068-0348-XX.

LITERATURE

Lab Bench Equipment Orientation Instructor guide and workbooks for CFC250, CFG250, CDM250 and CPS250 (50 workbooks, 1 guide). 062-9511-01.

Oscilloscope XYZs Primer Covers horizontal, vertical and trigger functions, controls, use of probes, terminology, and theory of waveforms and measurement techniques (50 primers). 062-9323-01.

ABCs of Probes (50 primers). 062-9471-00.

**1 Videotape included where noted.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

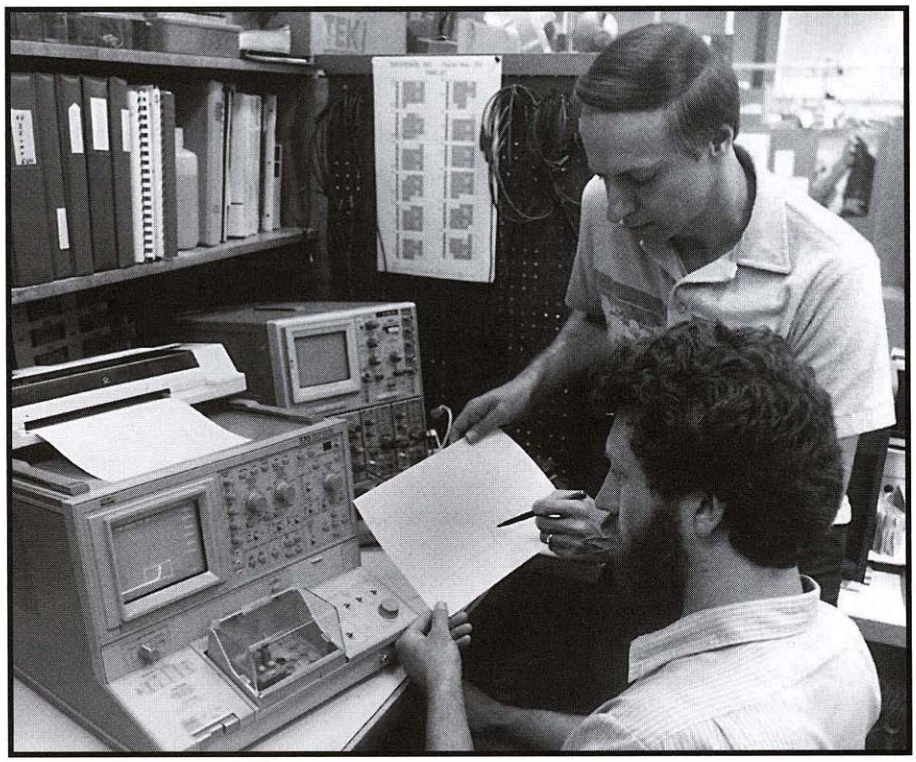
See Tektronix on the World Wide Web: http://www.tek.com

Semiconductor DC Characterization

Characterization and Test Solutions for Semiconductor Design, Manufacture and Quality Assurance

- The 370A provides a broad measurement range with up to 20 A capability.
- The 3000 W 371A has all the power you will need for high power semiconductors.
- Metrics ICS*1 software for interactive computer control of the 370A and 371A curve tracers.

*1 *Metrics ICS software is a trademark of Metrics Technologies.*



CONTENTS

370A Curve Tracer.....432
371A High Power Curve Tracer 434
Metrics ICS Software 436
Device Adapters 437

ACCESSORIES

Probes.....438
SMD Adapters.....472
Probe and Instrument Accessories 516
Printer.....522
Instrumentation Carts 524

Curve Tracer
370A

Features

- High Precision Measurements of Semiconductor Devices
  - Up to 2000 Volts or 10 Amp Sourcing
  - Up to 220 Watts
  - Down to 1 Nanoamp Measurement Resolution
- Down to 2 Millivolt Measurement Resolution
- Waveform Comparison
- Envelope Display
- Waveform Averaging
- Dot Cursor
- 3.5 Inch MS-DOS Compatible Disk Storage

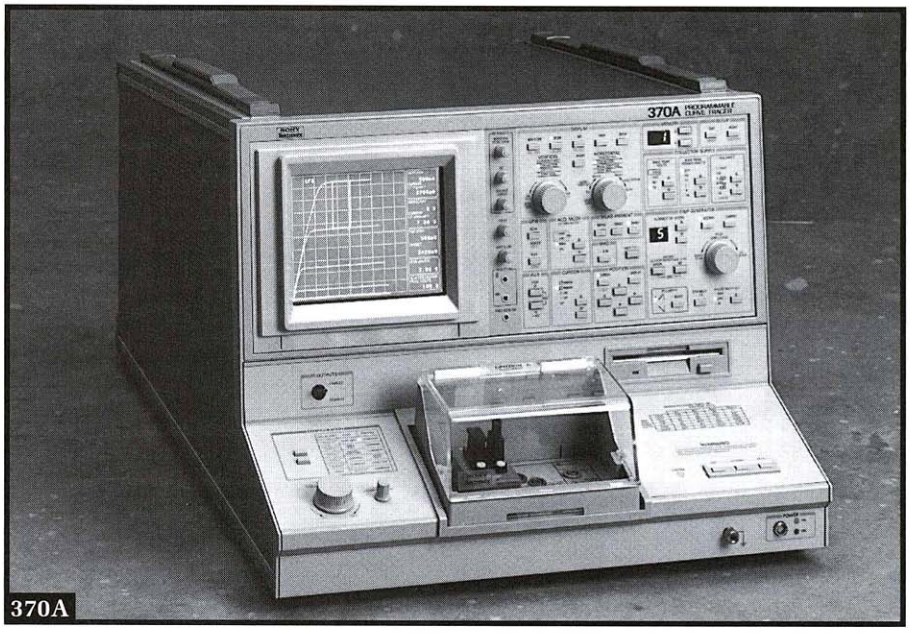
BENEFITS

- Kelvin Sense Measurements
- High Resolution Measurements
- Versatile Power Range
- Fully Programmable
- Save and Recall Setups Using Floppy Disk for Later Use

Applications

Manual or Automated High Resolution DC Parametric Characterization of Semiconductors

- Incoming Inspection
- Manufacturing Test
- Process Monitoring and Quality Control
- Data Sheet Generation
- Component Matching
- Failure Analysis
- Engineering



370A Programmable Curve Tracer

The 370A, the world standard for high resolution curve tracers is used in a wide variety of applications. The 370A performs DC parametric characterization of transistors, thyristors, diodes, SCRs, MOSFETs, optoelectronic components, solar cells, solid state displays and other semiconductor devices.

In the R&D lab, it is used for characterization of new designs, extraction of SPICE parameters, failure analysis, and data sheet generation.

In manufacturing test, the 370A is used to verify device quality and process monitoring.

The 370A is used for incoming inspection to verify device performance, perform failure analysis and to match components.

INTERACTIVE, PROGRAMMABLE CONTROL
Interactive control of all measurements is accomplished from the full featured front panel or over the GPIB. Operating parameters can be adjusted and stored and recalled using several storage methods including the 370A non-volatile memory, the built-in DOS compatible floppy disk or to an external controller.

TEST AND MEASUREMENT SOFTWARE
Metrics software offers computer-controlled DC parameter characterization of numerous semiconductor devices. Through Metrics ICS control of the 370A, measurements can be performed without the need to interact with the instruments front panel. Every aspect of instrument control and data analysis is available through a set of interactive dialog boxes that are configured in a graphics-oriented Microsoft Windows environment.

Turn to page 436 for more information about Metrics ICS software.

TEST FIXTURING
A test fixture is a standard accessory that provides safe device enclosure to ensure operator protection during measurements. The test fixture accommodates standard A1001 through A1005 adapters with Kelvin sensing, 3-Pin adapters without Kelvin sensing and the A1023 and A1024 surface mount adapters.

DIRECT HARDCOPY
Plotter output data can be sent directly from the 370A without the need for an external controller. Plotting can continue while the 370A performs the next tasks.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

Curve Tracer
370A

Source Characteristics

COLLECTOR SUPPLY

Modes – AC, ±DC, ±Leakage, ±Rectified Sine.

Range	Max Peak Current (±)	Peak Current Pulsed (±)*1
16 V	10 A	20 A
80 V	2 A	4 A
400 V	.4 A	.8 A
2000 V	.05 A	.1 A

*1 *Collector supply is not pulsed; assumes a pulsed step generator supply.*

STEP GENERATOR

Modes – Stair step: DC, 80 µsec pulse, 300 µsec pulse.

Step Range – Current: 50 nA to 200 mA in 1-2-5 sequence. Voltage: 50 mV to 2 V in 1-2-5 sequence.

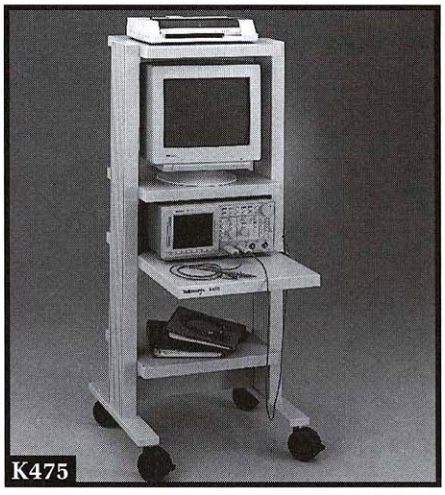
Offset – Up to ±10X step amplitude.

No. of steps – 0 to 10.

Measurement Characteristics

Collector Current – Measurement range: 100 nA/div (1 nA resolution) to 2 A/div. Accuracy: 1.5% of cursor readout +0.05 div of setting (with dot cursor).

Emitter Current – Measurement range: 1 nA/div (10 pA resolution) to 2 mA/div. Accuracy: 1.5% of cursor readout + 0.05 div of setting + 1 nA.



Accessory

K475

Instrument Cart

- Ergonomic design
- Simple height, angle, and shelf adjustments
- Durable steel and aluminum construction
- Large diameter smooth rolling casters
- Nylon safety straps included

For complete selection information on all Accessory products, see page 438.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

370A

Curve Tracer.

Includes: Blank Adapter A1001; In-line Transistor A1002, Axial Diode Lead Adapter A1005; 4 and 6 Lead Transistor/FET Adapter A1007; Floppy Diskette (119-3446-00); Protective Cover (337-3344-00); Spare Fuses 125 V/4 A (159-0259-00); Slow Blow 250 V/2 A Fuse (159-0160-00); Power Cord (161-0066-00); Operator's Manual (070-7779-00).

Opt. 1R – Rack Mounting.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES – Also see page 438.

Service Manual – Order 070-7780-00.

Calibration Fixture – Order 067-0187-00.

Rackmount Kit – Order 016-0930-00.

Socket Adapters – See adapters on page 437.

SOFTWARE

METRICS ICS Software – Requires 063-1650-00 drivers. Order 063-1649-00.

METRICS Software Drivers – Tektronix 37x Curve Tracer Drivers. Order 063-1650-00.

CART – Order K475.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

Curve Tracer
371A

Features

- High Power Measurements of Semiconductor Devices
  - Up to 3,000 Volts
  - Up to 400 Amps
  - Up to 3,000 Watts
- Waveform Comparison
- Envelope Display
- Waveform Averaging
- 3.5 Inch MS-DOS Compatible Disk Storage

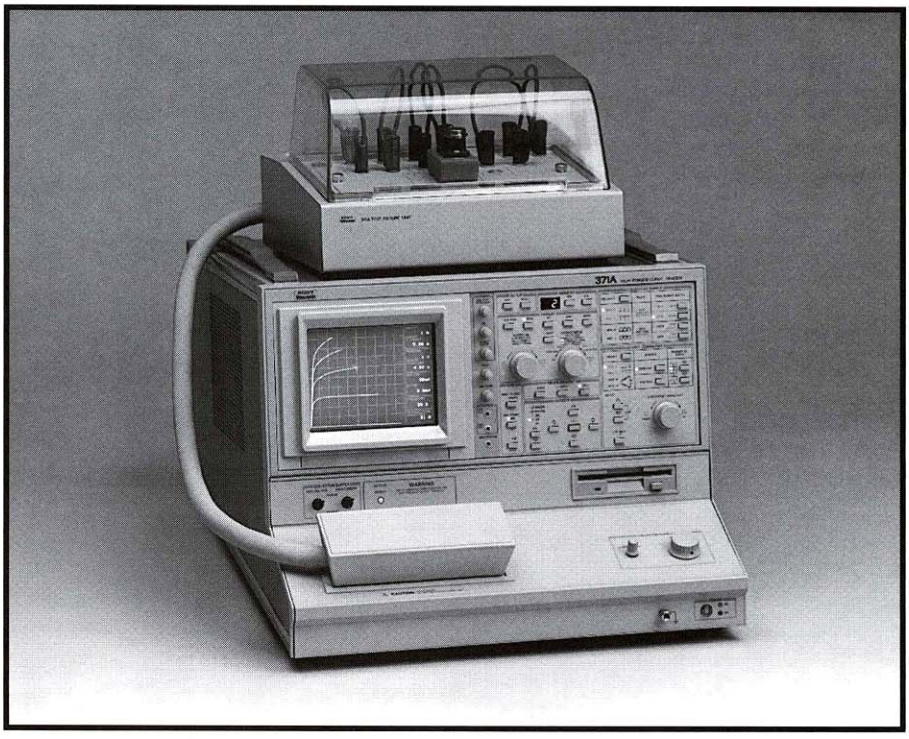
BENEFITS

- High Power to Test Power Semiconductors Like IGBTs
- Kelvin Sense Measurements
- Versatile Power Range
- Fully Programmable
- Save and Recall Setups Using Floppy Disk for Later Use

Applications

Manual or Automated DC Parametric Characterization of High Power Semiconductors

- Incoming Inspection
- Manufacturing Test
- Process Monitoring and Quality Control
- Data Sheet Generation
- Component Matching
- Failure Analysis
- Engineering



371A High Power Programmable Curve Tracer

The 371A, the industry leader in high power curve tracers is used for testing a wide variety of power semiconductors. It performs DC parametric characterization of thyristors, SCRs, IGBTs and power MOSFETs.

The high voltage collector mode permits testing the Off-Characteristics of a device up to 3,000 volts. The pulsed high current collector mode provides output current pulses greater than 400 amps peak for testing On-Characteristics. It also permits high power testing up to 3,000 watts.

In the R&D lab, the 371A is used for characterization of new designs of power devices, extraction of SPICE parameters, failure analysis, and data sheet generation.

In manufacturing test, the 371A is used to verify device quality and process monitoring.

The 371A is used for incoming inspection to verify power device performance and perform failure analysis.

INTERACTIVE, PROGRAMMABLE CONTROL

Interactive control of all measurements can be done from the full featured front panel or over the GPIB. Operating parameters can be adjusted and stored and recalled using several storage methods including the 371A non-volatile memory, the built-in DOS compatible floppy disk or to an external controller.

AUTOMATED CURSOR MEASUREMENTS

The 371A provides three cursor measurement modes. The Dot cursor provides direct screen readout of voltage, current, gm or DC beta at any point. The Window cursor can be positioned between two curves to measure small signal beta or gm, and can also be used for visual go/no-go tests. The Function Line cursor provides screen readout of a slope or intercept value.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

Curve Tracer
371A

SWEEP MEASUREMENT MODE
In the sweep measurement mode, the 371A will automatically construct a family of curves while stimulating the device with low duty-cycle pulses. With this capability, power curves can be displayed without excessive heating of the device.

TEST FIXTURING
A test fixture is a standard accessory that provides safe device enclosure to ensure operator protection during measurements. The test fixture accommodates standard A1001 through A1005 adapters with Kelvin sensing, 3-Pin adapters without Kelvin sensing and the A1023 and A1024 surface mount adapters.

DIRECT HARDCOPY
Plotter output data can be sent directly from the 371A without the need for an external controller. Plotting can continue while the 371A performs the next tasks.

TEST AND MEASUREMENT SOFTWARE
Metrics ICS software offers computer-controlled DC parameter characterization of numerous semiconductor devices. Through Metrics ICS control of the 371A, measurements can be performed without the need to interact with the instrument's front panel. Every aspect of instrument control and data analysis is available through a set of interactive dialog boxes that are configured in a graphics-oriented Microsoft Windows environment.

Turn to page 436 for more information about Metrics ICS software.

Characteristics

COLLECTOR SUPPLY
Modes – High Current: 250 µsec pulses with max. peak of 30 volts. High Voltage: Full rectified sine with max. peak of 300 volts (positive and negative polarities for both modes).

Range	Peak Current	Peak Power
30 V	400 A	3 kW
30 V	40 A	300 W
300 V	40 mA ±20%	30 W
300 V	4 mA ±20%	3 W
3 kV	4 mA 0 ±20%	300 mW
3 kV	4 mA ±20%	30 mW

Measurement Characteristics

COLLECTOR CURRENT

Maximum Power Setting	Vertical Range (in 1-2-5 increments)
3 kW	1 A/div to 50 A/div
300 W	500 mA/div to 5 A/div
30 W	100 µA/div to 5 mA/div
3 W, 300 mW	10 µA/div to 500 µA/div
30 mW	1 µA/div to 50 µA/div

Accuracy: within 0.1 vertical division.

Test Fixture – Designed to allow easy connection to a variety of devices. It has a safety enclosure to assure operator protection. Special patch cords are provided for connecting large devices.

STEP GENERATOR
Modes – Current (stair step): DC, 500 µsec ±10% of pulse. Voltage (stair step): DC.

Step Range – Current: 1 mA/step to 2 A/step pulsed (hi current mode). 1 µA/step to 2 mA/step DC (hi voltage mode). Voltage: 200 mV/step to 5 V/step. Offset: ±10X step amplitude (5X in 5 V/step and 2 V/step settings).

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

371A
High Power Curve Tracer.
Includes: In-line Transistor A1002; TO3/TO66 Adapter A1003; Power Cord (070-6839-00); Operator's Manual (070-8043-00); and Pocket Reference Guide (070-6841-00).

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

ADDITIONAL ACCESSORIES – Also see page 438.
Field Wiring Cable – Order 198-5628-00.
Service Manual – Order 070-8044-02.
Calibration Fixture – Order 067-1345-00.
Rackmount Kit – Order 016-0930-00.
Socket Adapters – See adapters section on page 437.

SOFTWARE
METRICS ICS Software – Requires 063-1650-00 drivers. Order 063-1649-00.
METRICS Software Drivers – Tektronix 37x Curve Tracer Drivers. Order 063-1650-00.
CART – Order K475.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web: http://www.tek.com

Metrics Software

Features

- Control Test, Measurement and Analysis from the PC
- Drivers Support Both the 370A and 371A Curve Tracers
- Easy to Use, Microsoft Windows Environment

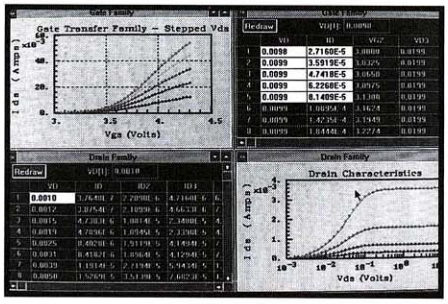
BENEFITS

- No Programming Needed
- Extend Measurement Capability Beyond Manually Operated Instrument
- Allows performing automated procedures
- Transfer Data Easily to Other Graphic or Analysis Programs With DDE Support

Applications

AUTOMATED DC PARAMETRIC CHARACTERIZATION OF

- Research and Development
- Incoming Inspection
- Process Monitoring and Quality Control
- Data Sheet Generation
- Component Matching
- Failure Analysis



Metrics Allows Comprehensive Instrument Control

Metrics control of the industry standard 370A and 371A Series curve tracers provide DC parameter characterization of numerous small signal and high-power semiconductor devices including diodes, bipolar transistors, MOSFETs, thyristors, ICs and IGBTs.

In addition to comprehensive instrument control, Metrics provides the capability to collect, analyze and display test data in the Microsoft Windows environment. Metrics robust drivers access all the accuracy and resolution of the 370A and 371A Series curve tracers while enhancing the instruments' versatility and ease of use.

POINT, CLICK AND MEASURE

The setup editor is a graphic workspace where test setups can be completely configured and saved without any programming. Test setups and instrument forcing conditions are constructed through point-and-click editing. Using the mouse, the test instrument, device type, interconnections and measurement conditions can be specified.

DATA COLLECTION AND ANALYSIS

From the data window, one or more plot windows with user-defined specifications can be created. To focus on any section of a plot, the zoom feature allows magnifying the area of interest.

Data analysis is supported with a full range of data reduction tools including five variable tracking and nontracking cursors, curve fitting, axes scaling and plot formatting. A vector/scaler engineering calculator provides advanced post processing and manipulation of the test data.

TEST MANAGEMENT UNDER GRAPHIC CONTROL

Metrics uses an advanced file management system to store and retrieve project files. When a device is tested, all information relating to that device is stored in a project file. The project file includes all test setups, forced test conditions, data and plot windows that were defined for a particular device.

AUTOMATED TESTING

Metrics supports automated testing with several convenient capabilities. The automatic test sequence function runs a series of tests on a device by simply pushing one button. When testing a large group of devices, the Autostore function will store data for each device in a separate, sequentially number file.

MAKE MEASUREMENTS NOT POSSIBLE FROM MANUAL CONTROL

In Metrics, any instrument supply can be configured for sweep, step or constant mode, something not possible from the front panel. For example, the software can be configured to sweep the base supply while stepping the collector supply.

An additional capability is the ability to set step quantity or step size beyond those available from the front panel. Metric allows specifying any step size and step quantity within the power capabilities of the instrument.

Metric's Autoscaling mode eliminates the need to manually search through various scaling ranges to optimize measurement results.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

METRICS ICS SOFTWARE

Core Program – Requires 063-1650-00 drivers to operate 37xA curve tracers. Order 063-1649-00.

METRICS SOFTWARE DRIVERS

370A and 371A Series Curve Tracer Drivers – Order 063-1650-00.

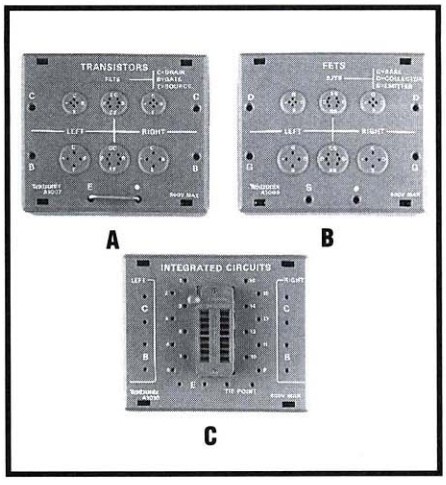
Semiconductor Testers

Device Adapters

Features

ADAPTERS

- Dual Width Adapters
- Kelvin Sensing Adapters
- SMT Device Adapters

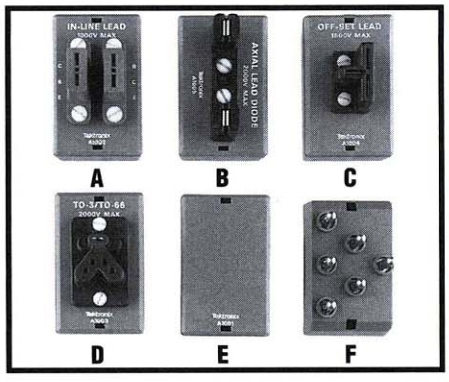


DUAL WIDTH ADAPTERS
Adapters A1006 through A1010 fit the side-by-side terminals on test fixtures of the 370A Curve Tracer. These adapters allow either 1 or 2 devices mounted in the adapter which is useful for alternating comparisons of two devices.

A. Transistor Adapters for Bipolar Transistors and some MOSFETs – Order A1007.

B. FET Adapter for most FETs – Order A1009.

C. Integrated Circuit Adapter for Multi-Pin Dual-in-Line Device Packages – The pins are connected to the collector, base or emitter terminals with patch cords. A tie point is also provided for an external power supply or signal source connection to the IC pins. Includes one each lead for connecting auxiliary supply to the tie points (196-3067-00); six each 4-inch test leads (012-0310-00). Order A1010.



KELVIN SENSING ADAPTERS
These adapters fit the test fixtures of the 370A and 371A Curve Tracer.

A. In-Line Adapter – Accepts large and small TO-220 transistors with in-line leads. Spacing between leads is 0.06 inch to 0.18 inch. The adapter is wired for both B-C-E and C-B-E lead configurations. Order A1002.

B. Axial Lead Diode Adapter – Order A1005.

C. Offset Lead Adapter for Power Transistor – Order A1004.

D. TO-3/TO-66 Adapter for Power Transistors – Order A1003.

E. Blank Adapter for Mounting Custom Sockets – Order A1001.

F. Example Showing Adapter Bottom 6th Pin for Base/Gate Kelvin Sensing

A1023 SOT-23 Adapter.

SMT DEVICE ADAPTERS
SOT-23 Adapter for Surface Mount Devices – Order A1023.

TO 252/SMT DPack Adapter for Surface Mount Devices – Order A1024.

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Accessories

CONTENTS

ACCESSORIES INTRODUCTION
Probing Tutorial 439

PROBES
Oscilloscope to Probe Cross Reference..442
Discontinued Instruments Replacement Probes 444
Probe Specification Chart.....448
Discontinued Probe/Replacements 450
FET Voltage Probe Tutorial 452
FET Voltage (Active) Probes.....454
50 Ω Divider Probes (Zo).....461
Passive Voltage Probes.....462
SMD Probes/Adapters.....472
SMD Interconnect Solutions 474
Articulated Arm 477

PROBE ADAPTERS & REPLACEMENT PARTS
Replacement Parts 478
P656XA and P6240 Probe Parts 480
P6150/P6207/P6217/SD14 (4 mm) 481
2.5 mm (Subminiature).....482
3.5 mm (Compact).....484
5 mm (Miniature).....486
Monolithic/P6015A/P6201 488
P5100/P5102/SMD Active.....490

POWER MEASUREMENT PROBES
High Voltage Probes 492
Differential Probes 494
Voltage Isolators 502
Current Probes.....505

OTHER PROBING COMPONENTS
Digital Word Trigger Probes.....515

PROBE & INSTRUMENT ACCESSORIES
Probe Packs, Cables, Test Leads.....516
Adapters/Connectors.....519
Attenuators/Terminators 520

DOCUMENTATION DEVICE
Printer (Thermal) 522

SOFTWARE
Wavestar Software 112

INSTRUMENTATION CARTS.....524

OTHER INSTRUMENTATION ACCESSORIES
Travel Kits 528
Viewing Hoods.....530
Rackmount Kits.....531
Light Filters 532

With Tektronix, the Difference Is Measurable

Whether you're using a scope from our revolutionary TDS 300/400/500/600/700, TAS or 11000 Series, our portable 2400 or 2200 Series, or our TLS Series, you've invested in the finest line of measurement instruments available. That's why it doesn't pay to compromise performance with unreliable accessories.

A dependable probe is essential to completing your test system because even the most advanced scope can only be as precise as the data that goes into it. Off-the-shelf general-purpose probes are frequently unreliable and are not expressly designed for your scope. They can cost you in ways you never bargained for: greatly impaired measurement results, embarrassing errors, and expensive delays.

PLUG IN PEACE OF MIND

Only genuine Tektronix probes measure up to your Tektronix scope, with designed-in compatibility and identical standards for quality, for performance you can always depend on.

Of course, choosing the *right kind* of probe is equally important, which is why we offer the world's largest and most respected line: passive and active voltage probes, current probes, high voltage probes, opto-electrical converters, specialty probes, and SMD probes designed for dense circuitry. All are built with the kind of ruggedness, reliability and long life that add up to the best probe value on the market. And they're complimented by an amazingly wide array of probe accessories for virtually every need.

DOCUMENTATION, CARTS AND WORKSTATIONS

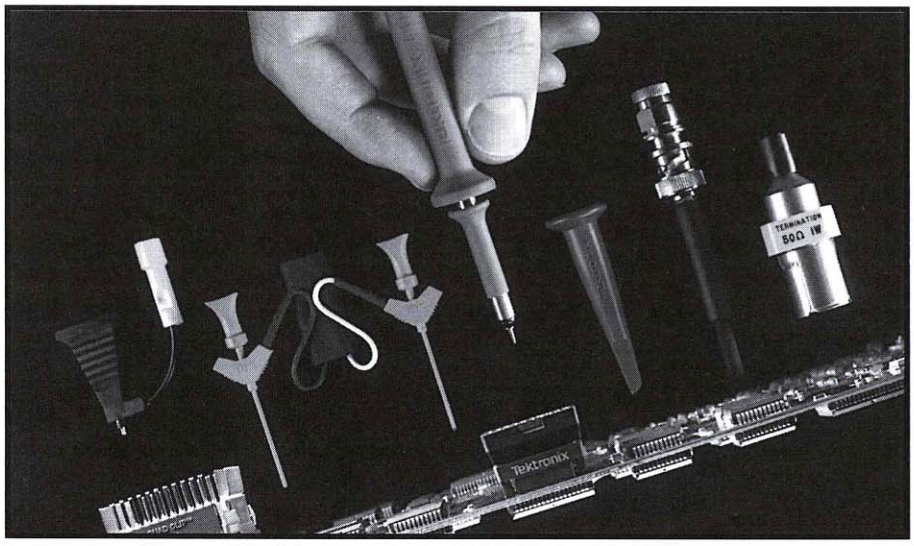
We also provide products for documenting your measurement results, a step that's become almost as essential as testing itself. As with our probes, only Tektronix software and printers are precision-matched to your instrument and applications. They're exceptional values, too, as are TEKSCOPE-MOBILE® carts and workstations which free up bench space and make equipment easy to share and move around.

SUPPORT IN EVERY SENSE OF THE WORD

Tektronix products come with all the back-up you could ever need: generous warranties, optional extended service plans, and parts and service that are always readily available. Plus we offer the convenience of Tektronix' worldwide field office network for in-person product demos, service, and other assistance.

Even more than that, expert personal guidance is as close as your phone any time you need help in choosing and using Tektronix products. And we're always ready to assist you with the widest choice of training materials in the industry.

An extra measure of performance, compatibility, quality, and support – added value that increases your productivity without raising your costs. That's the competitive advantage you get with every Tektronix product.



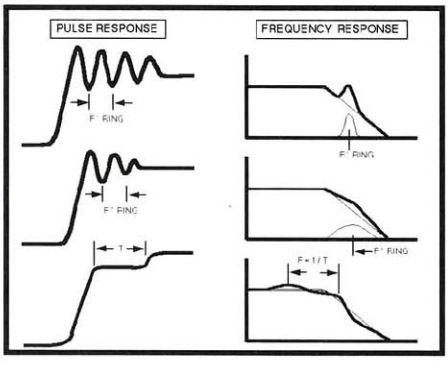
Probe Tutorial

Tektronix Instrument Probes

A probe can be any conductor used to establish a connection between the circuit under test and the measuring instrument. This conductor could be a piece of bare wire, a multimeter lead, or a piece of unterminated coaxial cable.

These "simple probes", however, do not fulfill the essential purpose of a probe; that is, "to extract minimal energy from the circuit under test and transfer it to a measuring instrument with maximum fidelity." The bare wire can load the input amplifier with its high capacitance and inductance or even cause a short circuit; multimeter leads are unshielded and are often susceptible to stray pickup, and the unterminated coax will severely capacitively load the circuit under test (100 pF per meter typically). Also, the unterminated coax is usually resonant at certain frequencies and does not allow faithful transfer of the signal to the test instrument due to reflections.

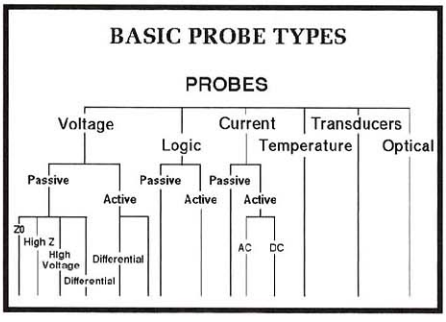
Tektronix has been designing and manufacturing instrument probes for more than 40 years, placing a constant effort on minimizing the reflections and other effects associated with unterminated coaxial probe cables and to reduce the effect of coaxial probe cables' capacitance in today's high-speed probing products.



This brief tutorial will quickly review the basic probe types and look at some of the more common issues around probe selection.

Types of Probes

Tektronix probe products include General Purpose Passive Voltage Probes, Active (FET) Voltage Probes, SMD Passive Voltage Probes, Active and Passive Current Probes, High Voltage Passive Probes, 50 Ω Divider Passive Voltage Probes (Zo, low impedance/high frequency), and Differential Voltage Probes, to name a few.



GENERAL PURPOSE PASSIVE (Page 462)
Attenuating Passive Voltage Probes are the most commonly used probes today. They provide a convenient and extremely rugged, yet inexpensive, way to acquire signals from your device under test. They maintain the accuracy of the oscilloscope to which they are connected over a wide dynamic range (±400 V). The 10X passive voltage probe presents a high impedance to the circuit under test at low frequencies (approximately 5 MHz and lower). Their main disadvantage is a decreasing impedance level with increasing frequency (i.e., high input capacitance).

ACTIVE FET PROBES (Page 454)
FET probes include active components (field effect transistors or other active devices) rather than passive components. The FET input results in a higher input impedance without loss of signal, i.e., low input capacitance (typically <0.4 pF to <2 pF), and high input resistance values (typically >100 kΩ). Some FET probes include an offset control that allows a substantial increase in the active probe's linear dynamic range. Since FET probes have a 50 Ω output impedance, they can drive a 50 Ω cable. This capability allows the distance from the probe tip to the instrument to be increased within the practical limits of the probe amplifier system and the limitations of the coaxial cable.

HIGH VOLTAGE PASSIVE (Page 492)
Several high voltage probes are available from Tektronix that provide 100X or 1000X compensated dividers. Because of the larger attenuation factors required for high voltage applications, the input capitance is reduced to approximately 3 pF.

CURRENT PROBES (Page 505)
Current probes provide a method to measure the current flowing in a circuit. Two types of current probes are available, the traditional AC only probes and the "Hall Effect" semiconductor type. AC only current probes use a transformer to convert current flux into AC signals and have a frequency response from a few hundred Hz to GHz. Combining a "Hall Effect" device with an AC transformer provides a frequency response from DC to 50 MHz. Because of its "non-invasive" nature, a current probe typically imposes less loading than other probes.

50 Ω DIVIDER PROBES (Z0) (Page 461)
50 Ω Divider Probes provide the lowest input capacitance (typically <1 pF for high frequency signals) and are used with high frequency, 50 Ω input scopes. 50 Ω Divider Probes provide the most consistent probe loading because they exhibit a frequency response that is essentially flat throughout their designed frequency range.

DIFFERENTIAL PROBES (Page 494)
Tektronix differential probes are available with high common mode rejection ratio. The normal 10X probe has a typical accuracy of ±1% and gives a differential measurement accuracy of two parts per 100. Using this 10X probe, the common mode rejection ratio of a scope and probe combination would be no better than 50:1. A matched pair (P6135A) of differential probes allows the user to adjust the probe's attenuation for compatibility with a variety of Tektronix amplifiers to provide common mode rejection ratios of 10,000:1 and higher. This attenuation adjustment includes probe compensation so the probes match at high frequency as well as low frequencies.

Probe Tutorial

PROBE SELECTION CRITERIA

Proper probe selection will extend and enhance an instrument's performance, while imprudent probe selection often reduces your system's performance. Thoughtful consideration of probe characteristics will help ensure that the performance of your instrument meets your application's requirements. While the major considerations for an appropriate probe are its loading and signal fidelity transfer, physical parameters such as probe size, cable length and device under test interconnect adapters are potentially more important to the success of your measurement.

For a complete understanding and description of signal acquisition probing techniques, issues and applications, the following information is available by contacting your local Tektronix representative.

"ABC's of Probes" –
- Literature # 60W-6053-5 (Free)

"Probing High Frequency Digital Circuitry" –
- Literature # 60W-8412-1 (Free)

"The Effect of Probe Input Capacitance on Measurement Accuracy" –
- Literature # 60W-8910-1 (Free)

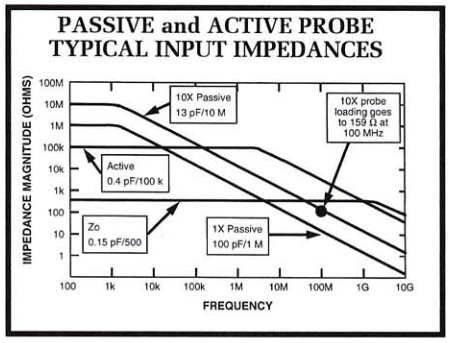
"Probe and Signal Concepts" –
- Videotape and Workbook.
  Order 068-0229-XX specify tape format:
  - 01 Beta
  - 02 Beta II
  - 03 Beta III
  - 04 VHS NTSC
  - 06 VHS PAL
  - 07 VHS SECAM

"Differential Oscilloscope Measurements" –
- Literature # 51W-10540-1

CRITERIA

Bandwidth/Rise Time

The bandwidth of a probe can be defined as the maximum –3 dB frequency a user can expect with a scope/probe system. In most probes, the bandwidth/rise time product is close to 0.35. In many cases the bandwidth is verified by pulse rise time to ensure minimum aberrations. To define these parameters accurately, the source impedance is specified as a terminated 50 Ω system (i.e., 25 Ω).



Probe Loading

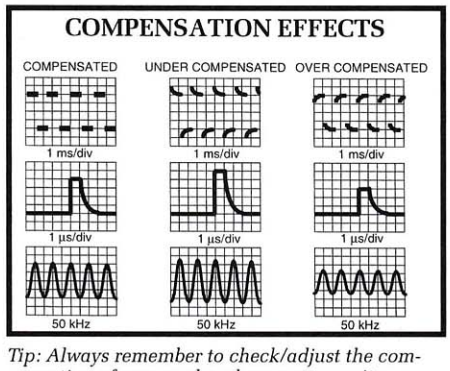
Input resistance and capacitance is used to describe the loading effect of a probe. At low frequencies (<1 MHz) the probe input resistance is the key factor for probe loading of the circuit under test. At higher frequencies the probe input capacitance is now the significant factor. The chart above shows various probes and changes in their impedance as frequency changes.

Aberrations

A high frequency probe that is specified without limiting aberrations can provide very misleading measurements. Existing aberrations can indicate a severely distorted bandwidth/roll-off characteristic.

Compensation Range

The range of a scope's input capacitance over which a specific probe will compensate to provide a flat frequency/attenuation ratio.



Tip: Always remember to check/adjust the compensation of your probe when you move it between channels or to another scope.

Attenuator Ratio

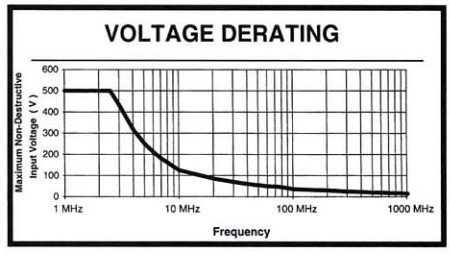
When correctly terminated, a probe should have a constant attenuation ratio. The attenuation ratio is the ratio of the output signal to the input signal. The attenuation should remain constant throughout a wide band of frequencies, decreasing by 3 dB as the frequency increases to the rated bandwidth.

Maximum Voltage

The maximum voltage (DC + peak AC) should be specified to ensure a usable, upper voltage range. At Tektronix, probes are tested in accordance with standard safety procedures.

Voltage Derating with Frequency

This specification is applicable for all high frequency probes. Either the termination elements or the resistive center conductor in the probe cable limits the maximum voltage that may be applied to a probe at a specific frequency. This derating applies at frequencies above 100 kHz.



Probe Length

Keep probe cable lengths as short as possible because extra length decreases the bandwidth and increases the loading capacitance of the probe. Longer probe cables also have greater propagation delays (typically 4 ns/meter in passive probes).

Probe Tip Accessories

A wide variety of adapters is available to mechanically connect the probe to the circuit under test (see page 480 for complete selection information). Since the probe tip conducts very little current, many materials that are normally considered to be good conductors have high resistance at lower current levels. Tektronix probe tips use an alloy coating to minimize current conduction problems.

Probe Coding

Probe coding provides the user with an indication of the actual probe tip sensitivity. This coding eliminates the need to divide by the attenuation ratio or remember which probe is being used. Most passive probes today provide readout capability that allows you to read your measurements directly from the oscilloscope screen.

Maximum Current (CW)

The maximum sine wave current that can be measured with a specified current probe without distortion.

Maximum Current (Pulse)

The maximum current pulse that can be measured with a specified current probe without distortion limited by Amp-Second (A-S) product.

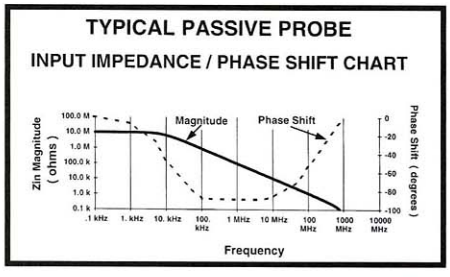
Probe Tutorial

Amp-Second Product
The maximum integral of the Pulse Current Waveform that may be measured without distortion. (See page 506 for more detail.)

Maximum DC Current
At levels lower than the RMS current specification, a DC level will saturate AC-only current probes causing distortion and insertion impedance changes. The impedance reflected into the circuit being measured is normally in the form of resistance and inductance.

PROBING CONSIDERATIONS AND RULES OF THUMB

A prime consideration in selecting the proper probe is the circuit loading effect of the oscilloscope/probe combination. The probe with the highest input impedance (lowest input capacitance and highest input resistance) will provide the least circuit loading. As circuit frequency increases and/or rise time decreases, the capacitive loading becomes most important. At DC and low frequencies the resistive loading is the most important.



Capacitive loading of voltage probes is the most important consideration when measuring fast rise time pulses. The time required to charge the input capacitance of the probe from the 10 to 90% level is

$$t_r = 2.2 \times R_{source} \times C_{probe}$$

Probe only rise time is the rise time of the probe driven from a terminated 50 Ω source. From this formula the rise time of the probe/oscilloscope system may be calculated for non passive probes that terminate in 50 Ω.

$$t_r^2\ _{system} = t_r^2\ _{probe} + t_r^2\ _{scope}$$

Bandwidth (3 dB down) of the probe/oscilloscope system may be calculated, knowing the system rise time and using the formula

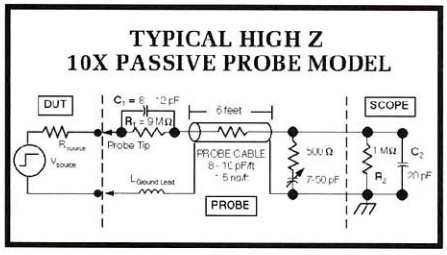
$$BW \approx 0.35 / t_{rise}$$

As you can see, these formulas are all dependent upon the input capacitance of the probe/oscilloscope system. **Since input capacitance plays such an important role, carefully consider the value of the probe's input capacitance when selecting your probe.**

Probe attenuation ratio is also an important consideration. The oscilloscope must have enough gain to allow viewing of the attenuated signal when using probes with larger attenuation ratios.

When an attenuating probe is used with an oscilloscope, the input resistance and input capacitance of the oscilloscope are represented by R_2C_2, and the probe resistance and capacitance are represented by R_1C_1 (see the figure below).

$R_2C_2 = R_1C_1$ = Optimum Signal Transfer



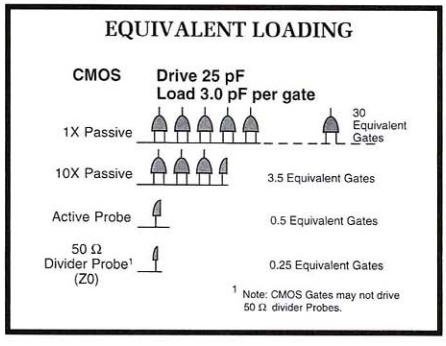
When the probe is first connected to the oscilloscope, compensate it by applying a low frequency square wave (1 to 10 kHz normally) to achieve the equalization of time constants. Improper compensation will result in either overshoot, roll-off or incorrect signal amplitudes (see Compensation Effects figure page 440).

The charts on pages 442 to 451 give you information on specifications, oscilloscope compatibility and obsolete probe replacements to help you select the right probe for your application.

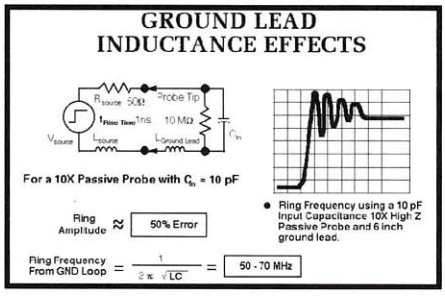
CONSIDER THE FOLLOWING FACTORS IN MAKING YOUR PROBE SELECTION:

- **Match Probe to Scope Input Resistance and Input Capacitance –** Be sure the desired probe will match the input resistance and capacitance of the oscilloscope being used. Fifty ohm (50 Ω) scope inputs will require 50 Ω probes. One Megaohm (1 MΩ) scope inputs will require 1 MΩ probes. Also check for connector interface compatibility or choose the appropriate adapter required. 1 MΩ inputs may also be used with appropriate 50 Ω adapters.
- **Match to Scope Bandwidth and Rise Times –** Select a probe with adequate rise time and bandwidth for the oscilloscope and application.
- **Probe Loading Effects –** Minimize probe loading effects by selecting low-impedance test points. Although the input impedance of a probe is made as high as possible, it still will always have some finite effect on the circuit under test. Usually cathodes, emitters and sources are preferred over plates, collectors or drains. Inputs to high-impedance dividers should be used rather than the midpoints.

  Be aware of the fact that the input impedance of a probe varies inversely with frequency. Example: A probe having a bandwidth of 50 MHz and an input resistance of 10 MΩ at DC would have an input resistance of approximately 1.5 kΩ at 50 MHz. Choose the probe with the lowest possible input capacitance and highest input resistance for best overall signal fidelity.



- **Time Delay Effects –** Time delay differences must be considered, particularly in phase and time coincidence measurements and in differential measurement applications. Always use two probes of the same model and cable length when making skew or time difference measurements.
- **Grounding Effects –** Grounding practices should always be kept in mind, particularly in high-impedance probe applications. Using as short a ground path as possible (preferably a coaxial adapter or short ground connector) will minimize the effect of series inductance to the probe input.



Oscilloscopes to Probes

Cross Reference

RECOMMENDED PROBE CROSS REFERENCE

Scope	Passive 1X	10X	1X/10X	100X	1000X	SMD	50 OHM (Zo)	Active CMOS/TTL	All Technolog	Logic
11800, CSA800 Series Plug-Ins										
SD20							P6150	P6245;w 1103	P6217;W 1103	
SD22							P6150	P6245;w 1103	P6217;W 1103	
SD24							P6150	P6245;w 1103	P6217;W 1103	
SD26							P6150	P6245;w 1103	P6217;W 1103	
SD30							P6150	P6245;w 1103	P6217;W 1103	
SD32							P6150	P6245;w 1103	P6217;W 1103	
TDS 200/300/400/500/600/700/800 and TLS200 Series										
TDS210	P6101B	P6112	P6119B	P5100	P6015A	P6561A		P6243S	P6243S	P6408
TDS220	P6101B	P6112	P6119B	P5100	P6015A	P6561A		P6243S	P6243S	P6408
TDS340A	P6101B	P6109B	P6129B	P5100	P6015A	P6562A		P6205;w/1103	P6243S	P6408
TDS360	P6101B	P6111B	P6129B	P5100	P6015A	P6562A		P6205;w/1103	P6243S	P6408
TDS380	P6101B	P6114B	P6129B	P5100	P6015A	P6562A		P6205;w/1103	P6243S	P6408
TDS420A	P6101B	P6138A	P6129B	P5100	P6015A	P6562A	P6156	P6205	P6243	P6408
TDS430A	P6101B	P6138A	P6129B	P5100	P6015A	P6562A	P6156	P6205	P6243	P6408
TDS460A	P6101B	P6138A	P6129B	P5100	P6015A	P6562A	P6156	P6205	P6243	P6408
TDS510A	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS520C	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS540C	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS620B	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS640A	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6205	P6245	P6408
TDS644B	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS680B	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS684B	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS724C	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS754C	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS784C	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TDS820							P6150 (1X/10X)	P6207	P6207	
TLS216									P6240	
THS700 Series										
THS710A	P6101B	P6117	P6129B	P5102; (10X High Voltage)					P6408	
THS720A	P6101B	P6117	P6129B	P5102; (10X High Voltage)					P6408	
THS720P	P6101B	P6117	P6129B	P5102; (10X High Voltage)					P6408	
THS730A	P6101B	P6117	P6129B	P5102; (10X High Voltage)					P6408	
TLA700 Series (Plug-Ins)										
TLA7D1	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TLA7D2	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TLA7E1	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6245	P6217	P6408
TLA7E2	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6245	P6217	P6408
TVS Series (VXI Plug-Ins)										
TVS621	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TVS625	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
TVS641	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6245	P6217	P6408
TVS645	P6101B	P6139A		P5100	P6015A	P6563A	P6156	P6245	P6217	P6408

Oscilloscopes to Probes
Cross Reference

RECOMMENDED PROBE CROSS REFERENCE

Scope	Differential Digital/Telecom	MicroVolt	High Voltage	Current AC Only	AC/DC	Electro-Optical Converter	Documentation Software		Cart
11800,CSA800 Series Plug-Ins									
SD20									
SD22									
SD24									
SD26									
SD30									
SD32									
TDS 200/300/400/500/600/700/800 and TLS200 Series									
TDS210		ADA400A;w/1103	P5200	P6021	AM503S		WSTR31	HC411	
TDS220		ADA400A;w/1103	P5200	P6022	AM503S		WSTR31	HC411	
TDS340A	P6246;w/1103	ADA400A;w/1103	P5200	P6021	AM503S		WSTR31	HC411	K212
TDS360	P6246;w/1103	ADA400A;w/1103	P5200	P6021	AM503S		WSTR31	HC411	K212
TDS380	P6246;w/1103	ADA400A;w/1103	P5200	P6021	AM503S		WSTR31	HC411	K212
TDS420A	P6246	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS430A	P6246	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS460A	P6246	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS510A	P6246; P6247	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B	WSTR31		K420
TDS520C	P6246; P6247	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B	WSTR31		K420
TDS540C	P6246; P6247	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B	WSTR31		K420
TDS620B	P6246; P6247	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS640A	P6246; P6247	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS644B	P6246; P6247	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS680B	P6247; P6246	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS684B	P6247; P6246	ADA400A	P5205; P5210	P6021	AM503S; TCP202	P6701B; P6703B	WSTR31		K420
TDS724C	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B	WSTR31		K420
TDS754C	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B	WSTR31		K420
TDS784C	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B	WSTR31		K420
TDS820	P6247;w/1103				AM503S;w/adapters		WSTR31		K420
TLS216									K420
THS700 Series									
THS710A				A621; A605	A622; A610		WSTR31		
THS720A				A621; A605	A622; A610		WSTR31		
THS720P				A621; A605	A622; A610		WSTR31		
THS730A				A621; A605	A622; A610		WSTR31		
TLA700 Series (Plug-Ins)									
TLA7D1	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			
TLA7D2	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			
TLA7E1	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			
TLA7E2	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			
TVS Series (VXI Plug-Ins)									
TVS621	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			
TVS625	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			
TVS641	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			
TVS645	P6247; P6246	ADA400A	P5205; P5210	P6021	TCP202; AM503S	P6701B; P6703B			

Discontinued Instruments

Accessories Replacement Guide

SUGGESTED REPLACEMENT

Instrument	Passive 1X	10X	1X/10X	100X	1000X	SMD	50 OHM (Zo)	Active CMOS/TTL	All Technologies	Logic
11000 Series										
11201/A	P6101B	P6134C		P5100	P6015A	P6562A		P6243;P6205	P6245	
11A16										
11A32/34	P6101B	P6134C		P5100	P6015A	P6562A	P6156	P6243	P6245	P6408
11A33	P6101B	P6135A		P5100	P6015A	P6562A	P6156	P6243	P6245	P6408
11A34V	P6101B	P6134C		P5100	P6015A	P6562A				P6408
11A52							P6156	P6243	P6217	
11A71/72/81							P6156	P6245	P6217	
2200 and 2300 Series										
2201/05/10/14	P6101B	P6103B	P6119B	P5100	P6015A	P6561A				P6408
2211/12	P6101B	P6109B	P6129B	P5100	P6015A	P6561A				P6408
2213/13A/15/15A	P6101B	P6122	P6119B	P5100	P6015A	P6561A				P6408
2216/20/21/21A/24	P6101B	P6109B	P6129B	P5100	P6015A	P6561A				P6408
2225	P6101B	P6103B	P6119B	P5100	P6015A	P6561A				P6408
2230/32	P6101B	P6109B	P6129B	P5100	P6015A	P6561A				P6408
2235/35A	P6101B	P6109B	P6119B	P5100	P6015A					P6408
2235L	P6101B	P6122	P6119B	P5100	P6015A					P6408
2236/36A	P6101B	P6109B	P6129B	P5100	P6015A					P6408
2245/45A/46/46A	P6101B	P6109B	P6129B	P5100	P6015A	P6561A		P6205;w/1103	P6243S	P6408
2247/47A/52	P6101B	P6109B	P6129B	P5100	P6015A	P6561A		P6205;w/1103	P6243S	P6408
2300 Series										
2335/36/36YA/37	P6101B	P6109B	P6119B	P5100	P6015A					
2400 Series										
2430/30A/30M/31L	P6101B	P6133 25	P6129B	P5100	P6015A	P6562A	P6156		P6202A	
2432/32A/32M	P6101B	P6137	P6129B	P5100	P6015A	P6562A	P6156		P6201	
2439	P6101B	P6136 25	P6129B	P5100	P6015A	P6562A	P6156		P6202A	
2440/40M	P6101B	P6137	P6129B	P5100	P6015A	P6562A	P6156		P6201	
2445	P6101B	P6131	P6129B	P5100	P6015A	P6562A	P6156		P6202A	
2445A	P6101B	P6133 25	P6129B	P5100	P6015A	P6562A	P6156		P6202A	
2445B	P6101B	P6137	P6129B	P5100	P6015A	P6562A	P6156		P6202A	
2455A/55B	P6101B	P6136 25	P6129B	P5100	P6015A	P6562A	P6156		P6202A	
2465	P6101B	P6131	P6129B	P5100	P6015A	P6562A	P6156	P6202A	P6201	
2465A	P6101B	P6136 25	P6129B	P5100	P6015A	P6562A	P6156	P6202A	P6201	
2465B	P6101B	P6137	P6129B	P5100	P6015A	P6562A	P6156	P6202A	P6201	
2467	P6101B	P6136 25	P6129B	P5100	P6015A	P6562A	P6156		P6201	
2467B/67HD	P6101B	P6137	P6129B	P5100	P6015A	P6562A	P6156	P6202A	P6201	
200 Series										
222A/222PS/224		P850								
300 Series										
305/314/335/336/336A	P6101B									
390AD	P6101B	P6105A	P6129B	P5100	P6015A					
400 Series										
434/455/464/464M	P6101B	P6105A	P6129B	P5100	P6015A	P6561A			P6202A	P6408
465/465B/465M	P6101B	P6105A	P6129B	P5100	P6015A	P6561A			P6202A	P6408
466/468	P6101B	P6105A	P6129B	P5100	P6015A	P6561A			P6202A	P6408
475/475A/485	P6101B	P6106A	P6129B	P5100	P6015A	P6561A	P6156		P6201	P6408
5000 Series										
5A14N	P6101B				P6015A	P6561A				
5A15N5A18N	P6101B					P6561A				
5A21N/5A22N/5A26	P6101B	P6135A								
5A38N	P6101B	P6105A	P6129B	P5100		P6561A				

Discontinued Instruments

Accessories Replacement Guide

SUGGESTED REPLACEMENT (CONT.)

Instrument	Differential Gen	MicroVolt	High Voltage	Current AC Only	AC/DC	Optical/Electrical Converter	Software	Cart
11000 Series								
11201/A	P6246;P6247	ADA400A	P5205; P5210		TCP202	P6701B; P6703B		K475
11A16					A6302;A6303			
11A32/34	P6246	ADA400A	P5205; P5210		TCP202	P6701B; P6703B		
11A33	P6135A		P5205; P5210		TCP202	P6701B; P6703B		
11A34V								
11A52	P6246				TCP202	P6701B; P6703B		
11A71/72/81	P6246;P6247				TCP202	P6701B; P6703B		
2200 and 2300 Series								
2201/05/10/14		ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2211/12		ADA400A;w/1103	P5200	P6021;P6022	AM503S		WSTR31	K212
2213/13A/15/15A		ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2216/20/21/21A/24		ADA400A;w/1103	P5200	P6021;P6022	AM503S		WSTR31	K212
2225		ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2230/32		ADA400A;w/1103	P5200	P6021;P6022	AM503S		WSTR31	K212
2235/35A		ADA400A;w/1103	P5200					K212
2235L		ADA400A;w/1103	P5200					K212
2236/36A		ADA400A;w/1103	P5200					
2245/45A/46/46A	P6246;w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2247/47A/52	P6246;w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2300 Series								
2335/36/36YA/37		ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2400 Series								
2430/30A/30M/31L		ADA400A;w/1103	P5200				WSTR31	K212
2432/32A/32M		ADA400A;w/1103	P5200				WSTR31	K212
2439		ADA400A;w/1103	P5200					K212
2440/40M		ADA400A;w/1103	P5200				WSTR31	K212
2445		ADA400A;w/1103	P5200					K212
2445A		ADA400A;w/1103	P5200					K212
2445B		ADA400A;w/1103	P5200					K212
2455A/55B		ADA400A;w/1103	P5200					K212
2465	P6246;P6247 w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2465A	P6246;P6247 w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2465B	P6246;P6247 w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
2467	P6246;P6247 w/1103	ADA400A;w/1103	P5200					K212
2467B/67HD	P6246;P6247 w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
200 Series								
222A/222PS/224								
300 Series								
305/314/335/336/336A								
390AD								
400 Series								
434/455/464/464M		ADA400A;w/1103	P5200					K212
465/465B/465M		ADA400A;w/1103	P5200					K212
466/468		ADA400A;w/1103	P5200					K212
475/475A/485		ADA400A;w/1103	P5200					K212
5000 Series								
5A14N								
5A15N5A18N								
5A21N/5A22N/5A26								
5A38N								

Discontinued Instruments

Accessories Replacement Guide

SUGGESTED REPLACEMENT (CONT.)

Instrument	Passive 1X	10X	1X/10X	100X	1000X	SMD	50 OHM (Zo)	Active CMOS/TTL	All Technologies	Logic
5000 Series (Cont.)										
5A45/5A48/5D10	P6101B	P6105A	P6129B	P5100	P6015A	P6561A				
7000 Series										
7A13	P6101B	P6135A		P5100	P6015A					
7A15A/7A18/7A18A	P6101B	P6105A	P6129B	P5100	P6015A	P6561A			P6202A	
7A16A	P6101B	P6106A	P6129B	P5100	P6015A	P6561A			P6202A	
7A19/7A24							P6156 25		P6201	
7A22	P6101B	P6135A							P6202A	
7A26	P6101B	P6106A	P6129B	P5100	P6015A	P6561A			P6202A	
7A29/7A29P							P6156 25		P6201	
7A42		P6131	P6129B	P5100		P6561A	P6156 25		P6202A	
7D15/7D20		P6106A	P6129B		P6015A	P6561A				
TM500/5000 Mainframe Plug-Ins / OTHER										
AM502	P6101B	P6135A								
DC503A/504A/5004		P6106A								
DC505/505A		P6122								
DC508/508A		P6106A								
DC509/5009/510/5010		P6106A								
SC501/502/503	P6101B				P6015A					
SC504	P6101B	P6105A	P6129B	P5100	P6015A					
SI5010							P6156		P6202A	
TAS 200/400 Series										
TAS220/250	P6101B	P6103B	P6129B	P5100	P6015A	P6561A				P6408
TAS455/465/475	P6101B	P6109B	P6129B	P5100	P6015A	P6561A				P6408
TAS485	P6101B	P6111B	P6129B	P5100	P6015A	P6561A				P6408
TDS 300/400/500/600/700/800 Series										
TD1301	P6101B	P6109B	P6129B	P5100	P6015A	P6561A		P6205;w/1103	P6243S	
TDS310/320/340	P6101B	P6109B	P6129B	P5100	P6015A	P6561A		P6205;w/1103	P6243S	P6408
TDS350	P6101B	P6111B	P6129B	P5100	P6015A	P6561A		P6205;w/1103	P6243S	P6408
TDS410/410A/420/460	P6101B	P6138A	P6129B	P5100	P6015A	P6562A	P6156	P6205/P6243	P6204/P6245	P6408
TDS520/520A/520B	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS524A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS540/540A/540B	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS544A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS620/620A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS640/644A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS684A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS724A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS744/744A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
TDS754A/782A/784A	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6205/P6243	P6204/P6245	P6408
THM 400/500 AND THS 700 Series										
THM420	ATLDX1									
THM550/560/565	TXMDXPB									
THS710/720	P6101B	P6117	P6129BP5102; 10X High Voltage							
TVS Series										
TVS521/525/541/545	P6101B	P6139A	P6129B	P5100	P6015A	P6563A	P6156	P6243	P6245	P6408
DIGITIZERS										
RTD710A	P6101B	P6109B	P6129B	P5100	P6015A					
RTD720A							P6156		P6245	
SCD1000							P6156		P6245	
SCD5000							P6156		P6245; /1103	

Discontinued Instruments

Accessories Replacement Guide

SUGGESTED REPLACEMENT (CONT.)

Instrument	Differential Gen	MicroVolt	High Voltage	Current AC Only	AC/DC	Optical/Electrical Converter	Software	Cart
5000 Series (Cont.)								
5A45/5A48/5D10								
7000 Series								
7A13	P6246;w/1103	ADA400A;w/1103	P5200					
7A15A/7A18/7A18A		ADA400A;w/1103	P5200					
7A16A		ADA400A;w/1103	P5200					
7A19/7A24								
7A22		ADA400A;w/1103	P5200					
7A26		ADA400A;w/1103	P5200					
7A29/7A29P		ADA400A;w/1103						
7A42		ADA400A;w/1103						
7D15/7D20								
TM500/5000 Mainframe Plug-Ins // OTHER								
AM502								
DC503A/504A/5004								
DC505/505A								
DC508/508A								
DC509/5009/510/5010								
SC501/502/503			P5205; P5210					
SC504			P5205; P5210					
SI5010								
TAS 200/400 Series								
TAS220/250	P6246;w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
TAS455/465/475	P6246;w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
TAS485	P6246;w/1103	ADA400A;w/1103	P5200	P6021;P6022	AM503S			K212
TDS 300/400/500/600/700/800 Series								
TD1301								
TDS310/320/340		ADA400A;w/1103	P5200	P6021;P6022	AM503S		WSTR31	K212
TDS350		ADA400A;w/1103	P5200	P6021;P6022	AM503S		WSTR31	K212
TDS410/410A/420/460	P6246	ADA400A	P5205; P5210	P6021;P6022	AM503S; TCP202	P6701B; P6703B	WSTR31	K220
TDS520/520A/520B	P6246; P6247	ADA400A	P5205; P5210	P6021;P6022	TCP202; AM503S		WSTR31	K420
TDS524A	P6246	ADA400A	P5205; P5210	P6021;P6022	AM503S; TCP202	P6701B; P6703B	WSTR31	K420
TDS540/540A/540B	P6246; P6247	ADA400A	P5205; P5210	P6021;P6022	TCP202; AM503S		WSTR31	K420
TDS544A	P6246; P6247	ADA400A	P5205; P5210	P6021;P6022	AM503S; TCP202		WSTR31	K420
TDS620/620A	P6246	ADA400A	P5205; P5210	P6021;P6022	AM503S; TCP202	P6701B; P6703B	WSTR31	K420
TDS640/644A	P6246	ADA400A	P5205; P5210	P6021;P6022	AM503S; TCP202	P6701B; P6703B	WSTR31	K420
TDS684A	P6246	ADA400A	P5205; P5210	P6021;P6022	AM503S; TCP202	P6701B; P6703B	WSTR31	K420
TDS724A	P6247; P6246	ADA400A	P5205; P5210	P6021;P6022	TCP202; AM503S	P6701B; P6703B	WSTR31	K420
TDS744/744A	P6246	ADA400A	P5205; P5210	P6021;P6022	AM503S; TCP202	P6701B; P6703B	WSTR31	K420
TDS754A/782A/784A	P6247; P6246	ADA400A	P5205; P5210	P6021;P6022	TCP202; AM503S	P6701B; P6703B	WSTR31	K420
THM 400/500 AND THS 700 Series								
THM420				A605	A622			
THM550/560/565				A605	A622			
THS710/720				A621; A605	A622; A610		WSTR31	
TVS Series								
TVS521/525/541/545	P6046	ADA400A	P5205; P5210	P6021;P6022	TCP202;AM503S	P6701B; P6703B		
DIGITIZERS								
RTD710A		ADA400A;w/1103			AM503S			
RTD720A		ADA400A			TCP202;AM503S	P6701B; P6703B		
SCD1000								
SCD5000					TCP202;AM503S	P6701B; P6703B		

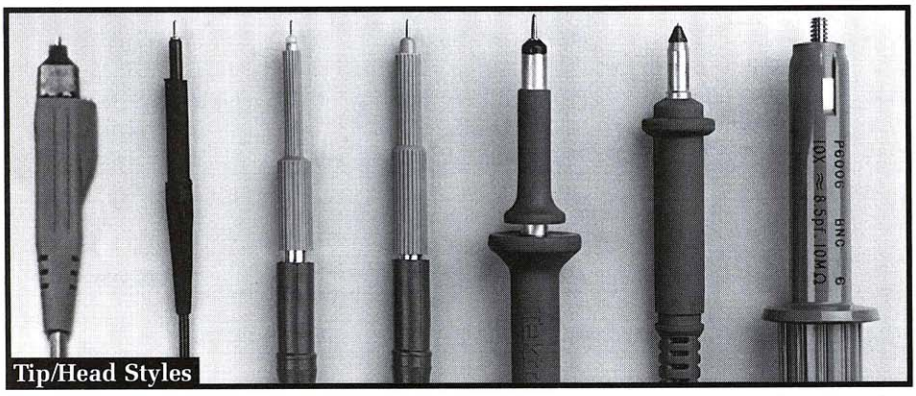
Probes
Specifications Chart

PASSIVE PROBES

Type	Cable Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Compensation Range	Read Out	ID/Gnd Ref.	Tip/Head Style	Page
1X Passive Probe											
P6101B	2 m	1	15 MHz	1 MΩ	100 pF	420 V	NA			5 mm (Min)	**464**
10X Passive Probes											
P5102	3.1 m	10	100 MHz	5 MΩ	11.2 pF	1000 V RMS	24 to 28 pF			mono.	**466**
P6103B	2 m	10	60 MHz	10 MΩ	13 pF	420 V	15 to 35 pF			5 mm (Min)	**464**
P6105A	2 m	10	100 MHz	10 MΩ	11 pF	500 V	15 to 35 pF	√	√	5 mm (Min)	**468**
Opt. 01	1 m	10	100 MHz	10 MΩ	9 pF	500 V	15 to 35 pF			5 mm (Min)	
Opt. 03	3 m	10	90 MHz	10 MΩ	13 pF	500 V	15 to 30 pF			5 mm (Min)	
P6106A	2 m	10	250 MHz	10 MΩ	11 pF	500 V	15 to 35 pF	√	√	5 mm (Min)	**468**
Opt. 01	1 m	10	250 MHz	10 MΩ	9 pF	500 V	15 to 35 pF			5 mm (Min)	
Opt. 03	3 m	10	150 MHz	10 MΩ	13 pF	500 V	15 to 30 pF			5 mm (Min)	
P6109B	2 m	10	100 MHz	10 MΩ	13 pF	420 V	15 to 35 pF	√		5 mm (Min)	**464**
P6111B	2 m	10	200 MHz	10 MΩ	14 pF	420 V	15 to 35 pF	√		5 mm (Min)	**464**
P6112	2 m	10	100 MHz	10 MΩ	13.3 pF	300 V RMS	15 to 35 pF			5 mm (Min)	**464**
P6114B	2 m	10	400 MHz	10 MΩ	14.1 pF	300 V RMS	10 to 35 pF	√		5 mm (Min)	**464**
P6117	2 m	10	200 MHz	10 MΩ	13.3 pF	300 V RMS	15 to 35 pF			5 mm (Min)	**464**
P6122	1.5 m	10	100 MHz	10 MΩ	11 pF	500 V	15 to 35 pF			5 mm (Min)	**468**
P6131	1.3 m	10	300 MHz	10 MΩ	10.8 pF	500 V	14 to 18 pF	√		2.5 mm (Sub)	**470**
Opt. 02	2 m	10	250 MHz	10 MΩ	13.5 pF	500 V	14 to 18 pF			2.5 mm (Sub)	
Opt. 03	3 m	10	150 MHz	10 MΩ	14.5 pF	500 V	14 to 18 pF			2.5 mm (Sub)	
P6133	2 m	10	150 MHz	10 MΩ	12.7 pF	500 V	10 to 25 pF	√		2.5 mm (Sub)	**470**
Opt. 01	1.3 m	10	150 MHz	10 MΩ	11.4 pF	500 V	10 to 25 pF			2.5 mm (Sub)	
Opt. 03	3 m	10	120 MHz	10 MΩ	14.5 pF	500 V	10 to 25 pF			2.5 mm (Sub)	
Opt. 25	1.3 m	10	150 MHz	10 MΩ	10.8 pF	500 V	10 to 25 pF			3.5 mm (Comp)	
P6134C	1.5 m	10	400 MHz	10 MΩ	11.3 pF	500 V	12 to 18 pF	√	√	3.5 mm (Comp)	**470**
P6136	1.3 m	10	350 MHz	10 MΩ	10.8 pF	500 V	12 to 18 pF	√		2.5 mm (Sub)	**470**
Opt. 25	1.3 m	10	350 MHz	10 MΩ	10.8 pF	500 V	12 to 18 pF			3.5 mm (Comp)	
P6137	1.5 m	10	400 MHz	10 MΩ	10.8 pF	500 V	12 to 18 pF	√	√	3.5 mm (Comp)	**470**
P6138A	1.3 m	10	350 MHz	10 MΩ	10 pF	300 V RMS	12 to 18 pF	√		3.5 mm (Comp)	**470**
P6139A	1.3 m	10	500 MHz	10 MΩ	8 pF	500 V	8 to 12 pF	√		3.5 mm (Comp)	**470**
P6561A	1.3 m	10	200 MHz	10 MΩ	<11 pF	42 V	15 to 35 pF	√		SMD	**472**
P6562A	1.3 m	10	350 MHz	10 MΩ	<11 pF	42 V	12 to 35 pF	√		SMD	**472**
P6563A	1.3 m	20	500 MHz	9.5 MΩ	<5 pF	42 V	7 to 30 pF	√		SMD	**472**

m = meters V = volts MHz = Megahertz mono. = monolithic HVP = high voltage probe MΩ = Megaohms pF = picofarads mm = millimeters

TIP/HEAD STYLES



SMD Active *SMD* *2.5 mm Subminiature* *3.5 mm Compact* *5 mm Miniature* *4 mm* *6/32 Thread Monolithic*

Probes
Specifications Chart

PASSIVE PROBES

Type	Cable Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Compensation Range	Read Out	ID/Gnd Ref.	Tip/Head Style	Page
1X/10X Switchable											
P6119B	2 m	1/10	10/100 MHz	1/10 MΩ	100/18 pF	420 V	15 to 35 pF			5 mm (min.)	**464**
P6129B	2 m	1/10	10/100 MHz	1/10 MΩ	100/18 pF	420 V	15 to 35 pF	√		5 mm (min.)	**464**
Y5060	1.5 m	1/10	50/60 MHz	1/10 MΩ	110/16.6 pF	500 V	20 to 45 pF			5 mm (min.)	**467**
Y5100	1.5 m	1/10	5/100 MHz	1/10 MΩ	110/16.6 pF	500 V	20 to 45 pF			5 mm (min.)	**467**
100X/1000X High Voltage											
P5100	3.1 m	100	250 MHz	10 MΩ	2.75 pF	2,500 V	7 to 30 pF	√		mono.	**492**
P6015A	3.0 m	1000	75 MHz	100 MΩ	3.0 pF	20,000 V	7 to 49 pF			HVP	**492**
Opt. 1R	3.0 m	1000	75 MHz	100 MΩ	3.0 pF	20,000 V	7 to 49 pF	√		HVP	
Opt. 25	7.6 m	1000	25 MHz	100 MΩ	3.0 pF	20,000 V	7 to 49 pF			HVP	
Opt. 2R	7.6 m	1000	25 MHz	100 MΩ	3.0 pF	20,000 V	7 to 49 pF	√		HVP	

ACTIVE PROBES

Type	Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Linear Range	DC Offset Range	ID/Gnd Ref.	Tip/Head Style	Page
P6201	1.8 m	1	900 MHz	100 kΩ	3.0 pF	±56 V	±0.6 V	±5.6 V		mono.	**458**
		10	900 MHz	1 MΩ	1.5 pF	±200 V	±6.0 V	±56 V		mono.	
		100	900 MHz	1 MΩ	1.5 pF	±200 V	±60 V	±200 V		mono.	
P6202A	2.0 m	10	500 MHz	10 MΩ	2.0 pF	±200 V	+6.0 V	±55 V		mono.	**458**
		100	500 MHz	10 MΩ	2.0 pF	±200 V	±60 V	±200 V		mono.	
P6204	1.5 m	10	1000 MHz	10 MΩ	1.9 pF	±40 V	±10 V	±15 V	√	5 mm (min.)	**456**
P6205	1.5 m	10	750 MHz	1 MΩ	2.0 pF	±40 V	±10 V	N/A		5 mm (min.)	**456**
P6207	1.6 m	10	4000 MHz	100 kΩ	0.4 pF	±40 V	±4.0 V	±5 V		4 mm	**456**
P6217	1.5 m	10	4000 MHz	100 kΩ	0.4 pF	±40 V	±4.0 V	±5 V		4 mm	**456**
P6243	1.3 m	10	1000 MHz	1 MΩ	1.0 pF	±40 V	±8.0 V	N/A		SMD Active	**472**
P6245	1.3 m	10	1500 MHz	1 MΩ	1.0 pF	±40 V	±8.0 V	±10 V		SMD Active	**472**

50Ω DIVIDER PROBES

Type	Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Instrument Input	Read Out	ID/Gnd Ref.	Tip/Head Style	Page
P6150	1 m	10	9 GHz	500 Ω	<0.15 pF	12.5 V RMS	50 Ω			Comp.	**461**
		1	≥3 GHz	50 Ω	N/A	*1	50 Ω				
P6156	1.5 m	10	≥3.5 GHz	500 Ω	≤1 pF	15 V RMS	50/1 MΩ	√	√	3.5 mm (Comp.)	**461**
Opt. 25		100	≥3.0 GHz	5000 Ω	≤1.1 pF	50 V RMS	50/1 MΩ				
		20	≥3.5 GHz	1000 Ω	≤1 pF	22 V RMS	50/1 MΩ				

DIFFERENTIAL PROBES/SIGNAL CONDITIONERS

Type		Type	
ADA 400A	For Specifications see page 498.	P6246/P6247	For Specifications see page 496.
P5200/P5205/P5210	For Specifications see page 500.	P6135A	For Specifications see page 499.
Kit for P5100	Order 040-1487-00. For Specifications see page 492.		

m = meters V = volts MHz = Megahertz mono. = monolithic HVP = high voltage probe MΩ = Megaohms pF = picofarads mm = millimeters

*1 *Limited by scope input or 42 V RMS.*
*2 *Limited by scope input or 50 V RMS.*

Discontinued Probes

Replacement Guide

PASSIVE PROBES

Type_Opt.	Cable Length Meter	Cable Length Feet	Atten	B/W at -3dB (MHz)	Input Impedance Resist (MOhm)	Input Impedance Cap (pF)	Max V (DC+ pk AC)	Comp Range Min(pF)	Comp Range Max(pF)	R/O	ID	Tip/Head Style	Suggested Replacement
P400	1.1	3.5	1	20	1	30	400	N/A	N/A	No	No	5 mm (min)	P850
P6006	1.8	6	10	25	10	11	600	15	55	No	No	Mono.	P6129B
P6006 03	2.7	9	10	25	10	11	600	15	55	No	No	Mono.	P6129B
P6006 04	3.7	12	10	12	10	15	600	15	55	No	No	Mono.	P6129B
P6007	1.8	6	100	20	10	2.2	1500	8	55	No	No	Mono.	P6009
P6007 01	1.1	3.5	100	25	10	2.0	1500	8	55	No	No	Mono.	P6009
P6007 03	2.7	9	100	15	10	2.4	1500	8	55	No	No	Mono.	P6009
P6007 04	3.7	12	100	13	10	2.6	1500	8	55	No	No	Mono.	P6009
P6008	1.8	6	10	100	10	7.5	600	12	47	No	No	Mono.	None
P6009 14	3.7	12	100	120	10	2.5	1500	8	55	Yes	No	Mono.	P6009
P6015	3.1	10	1000	75	100	3.0	40000	12	47	Yes	No	HVP	P6015A
P6015 10	3.1	10	1000	75	100	3.0	13000	12	47	Yes	No	HVP	P6015A
P6015 25	7.6	25	1000	8	100	4	40000	12	47	Yes	No	HVP	P6015A 2R
P6015 26	7.6	25	1000	8	100	4	13000	12	47	Yes	No	HVP	P6015A 2R
P6053	1.8	6	10	200	10	12.5	500	15	35	Yes	Yes	5 mm (min)	P6106A
P6053B	1.8	6	10	200	10	12.5	500	15	35	Yes	Yes	5 mm (min)	P6106A
P6053C	2	6.6	10	250	10	12.5	500	15	35	Yes	Yes	3.5 mm (Comp)	P6106A
P6053C 01	1.5	4.9	10	250	10	9.5	500	15	35	Yes	Yes	3.5 mm (Comp)	P6106A 01
P6053C 03	3	9.8	10	250	10	13.5	500	15	35	Yes	Yes	3.5 mm (Comp)	P6106A 03
P6056	1.8	6	10	3500	.0005	1	9	N/A	N/A	Yes	Yes	5 mm (min)	P6156
P6056 03	2.7	9	10	3500	.0005	1	9	N/A	N/A	Yes	Yes	5 mm (min)	P6156
P6057	1.8	6	100	1400	0.005	1	21	N/A	N/A	Yes	Yes	5 mm (min)	P6156 25
P6057 03	2.7	9	100	1400	0.005	1	21	N/A	N/A	Yes	Yes	5 mm (min)	P6156 25
P6062B	2	6.6	1/10	6.5/100	1/10	105/14	500	15	47	Yes	Yes	5 mm (min)	P6129B
P6062B 01	1.5	4.9	1/10	8/100	1/10	100/13	500	15	47	Yes	Yes	5 mm (min)	P6129B
P6062B 03	3	9.8	1/10	4.5/100	1/10	135/17	500	15	47	Yes	Yes	5 mm (min)	P6129B
P6063B	2	6.6	1/10	6/200	1/10	105/14	500	15	24	Yes	Yes	5 mm (min)	None
P6063B 01	1.5	4.9	1/10	12/200	1/10	80/11	500	15	24	Yes	Yes	5 mm (min)	None
P6101A	2	6.6	1	15	1	54	500	N/A	N/A	No	No	5 mm (min)	P6101B
P6101A 01	1	3.3	1	34	1	32	500	N/A	N/A	No	No	5 mm (min)	P6101B
P6101A 03	3	9.8	1	8	1	78	500	N/A	N/A	No	No	5 mm (min)	P6101B
P6102A	2	6.6	10	60	10	13	500	15	35	Yes	Yes	5 mm (min)	P6129B
P6103	2	6.6	10	50	10	13.2	500	15	35	No	No	5 mm (min)	P6103B
P6103 01	1	3.3	10	50	10	10.9	500	15	35	No	No	5 mm (min)	P6103B
P6103 03	3	9.8	10	50	10	15.5	500	15	35	No	No	5 mm (min)	P6103B
P6107A	2	6.6	10	100	10	13	500	20	51	Yes	No	5 mm (min)	P6129B
P6108A	2	6.6	10	200	10	11	500	15	35	No	No	5 mm (min)	P6105A
P6108A 01	1	3.3	10	100	10	9	500	15	35	No	No	5 mm (min)	P6105A 01
P6108A 03	3	9.8	10	90	10	13	500	15	35	No	No	5 mm (min)	P6105A 03
P6109	2	6.6	10	150	10	13.2	500	15	35	Yes	No	5 mm (min)	P6109B
P6109 01	1.5	4.9	10	150	10	11.8	500	15	35	Yes	No	5 mm (min)	P6109B
P6109 03	3	9.8	10	100	10	15.5	500	15	35	Yes	No	5 mm (min)	P6109B
P6113B	2	6.6	10	100	10	13.3	300 V RMS	15	35	No	No	Mono.	P6117
P6115	1.5	4.9	1	5	1	64	42	N/A	N/A	No	No	5 mm (min)	P6101B
P6119	2	6.6	1/10	8/100	1/10	120/15.3	350/500	15	35	No	No	5 mm (min)	P6119B
P6119 03	3	9.8	1/10	6.7/100	1/10	145/17.5	350/500	15	35	No	No	5 mm (min)	P6119B
P6121	1.5	4.9	10	100	10	11	500	20	26	No	No	5 mm (min)	P6109B
P6122 02	2	6.6	10	100	10	12	500	15	35	No	No	5 mm (min)	YT5100
P6122 03	3	9.8	10	90	10	14	500	15	35	No	No	5 mm (min)	YT5100
P6125	1.5	4.9	5	200	5	20	250	15	33	No	No	5 mm (min)	None

Discontinued Probes

Replacement Guide

Type_Opt.	Cable Length Meter	Cable Length Feet	Atten	B/W at -3dB (MHz)	Input Impedance Resist (MOhm)	Input Impedance Cap (pF)	Max V (DC+ pk AC)	Comp Range Min(pF)	Comp Range Max(pF)	R/O	ID	Tip/Head Style	Suggested Replacement
P6127	1.5	4.9	1/10	8/300	1/10	100/12.7	350/500	12	18	Yes	No	5 mm (min)	None
P6129	2	6.6	1/10	8/100	1/10	124/16	350/500	15	35	Yes	No	5 mm (min)	P6129B
P6130	2	6.6	10	250	10	13.2	500	15	35	Yes	No	2.5 mm (Sub)	P6106A
P6130 01	1.5	4.9	10	250	10	12.7	500	15	35	Yes	No	2.5 mm (Sub)	P6106A 01
P6130 03	3	9.8	10	150	10	14.5	500	15	30	Yes	No	2.5 mm (Sub)	P6106A 03
P6134	1.5	4.9	10	300	10	11.3	500	12	18	Yes	Yes	2.5 mm (Sub)	P6134C
P6138	1.3	4.3	10	350	10	10	500	12	18	Yes	No	3.5 mm (Comp)	P6138A
P6148A	2	6.6	10	50	10	13	500	20	51	Yes	No	5 mm (min)	None
P6149A	2	6.6	10	50	10	13	500	20	51	No	No	5 mm (min)	None
P6156 26	1.5	4.9	20	3500	0.001	1	22 V RMS	N/A	N/A	Yes	Yes	3.5 mm (Comp)	P6156 and 206-0381-00
P6156 27	1.5	4.9	1	1500	0.00005	N/A	50 V RMS	N/A	N/A	Yes	Yes	3.5 mm (Comp)	None
P6561AS	1.3	4.3	10	200	10	11	42	15	35	Yes	No	SMD	P6561A
P6562	1.5	4.9	10	350	10	10.3	42	15	30	Yes	No	SMD	P6562A
P6562AS	1.3	4.3	10	350	10	11	42	12	35	Yes	No	SMD	P6562A
P6563AS	1.3	4.3	20	500	9.5	5	42	7	30	Yes	No	SMD	P6563A

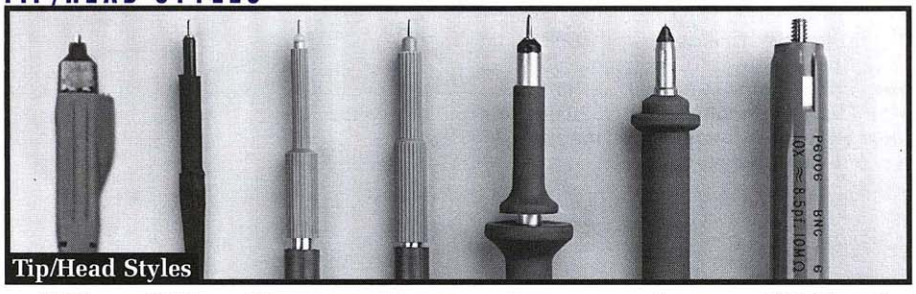
ACTIVE/DIFFERENTIAL PROBES

Discontinued Probe	Characteristics Attn	B/W MHz	Linear Range	DC Offset	Max Vin	Cin pF	Rin	Suggested Replacement	Changes in Characteristics Attn	B/W MHz	Linear Range	DC Offset	Max Vin	Cin pF	Rin
P6203	10	1000	±10 V	±10 V	40	2	10 k	P6204 w/1103 or	10	1000	±10 V	±10 V	40	1.9	10 M
								P6205 w/1103	10	750	±10 V	N/A	40	2	1 M
P6206	10	1000	±10 V	N/A	40	2	1 M	P6204 w/1103 or	10	1000	±10 V	±10 V	40	1.9	10 M
								P6205 w/1103	10	750	±10 V	N/A	40	2	1 M
P6230	10	1500	±5 V	±5 V	30	1.3	450	P6231 w/1103	10	1500	±5 V	±5 V	30	1.6	450
P6231	10	1500	±5 V	±5 V	30	1.6	450	P6245	10	1500	±8 V	±10 V	40	1.0	1 M
P6046	1/10	100	5/50 V	–	25	10	1 M	P6246/P6247 P6246/1103	1/10	400/1000	±7 V	–	25	2.0	200 k

VOLTAGE PROBE/PAGE INDEX

Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page
ADA 400A	**498**	*P6009*	**450**	*P6101B*	**464**	*P6111B*	**464**	*P6125*	**450**	*P6138*	**451**	*P6204*	**456**	*P6561A/AS*	**472**
P400	**450**	*P6015*	**450**	*P6102A*	**450**	*P6112*	**464**	*P6129*	**451**	*P6138A*	**470**	*P6205*	**456**	*P6562*	**451**
P5100	**492**	*P6015A*	**492**	*P6103*	**450**	*P6113B*	**450**	*P6129B*	**464**	*P6139A*	**470**	*P6206*	**451**	*P6562A/AS*	**472**
P5102	**466**	*P6046*	**451**	*P6103B*	**464**	*P6114B*	**464**	*P6131*	**470**	*P6148A*	**451**	*P6207*	**460**	*P6563A/AS*	**472**
P5200	**500**	*P6053*	**450**	*P6105A*	**468**	*P6115*	**450**	*P6133*	**470**	*P6149A*	**451**	*P6217*	**456**	*P850*	**492**
P5205	**500**	*P6053B*	**450**	*P6106A*	**468**	*P6117*	**464**	*P6134*	**451**	*P6150*	**461**	*P6230*	**451**	*YT5060*	**467**
P5210	**500**	*P6053C*	**450**	*P6107A*	**450**	*P6119*	**450**	*P6134C*	**470**	*P6156*	**461**	*P6231*	**451**	*YT5100*	**467**
P6006	**450**	*P6056*	**450**	*P6108A*	**450**	*P6119B*	**464**	*P6135A*	**499**	*P6201*	**458**	*P6243*	**472**		
P6007	**450**	*P6057*	**450**	*P6109*	**450**	*P6121*	**450**	*P6136*	**470**	*P6202A*	**458**	*P6243S*	**454**		
P6008	**450**	*P6101A*	**450**	*P6109B*	**464**	*P6122*	**468**	*P6137*	**470**	*P6203*	**451**	*P6245*	**472**		

TIP/HEAD STYLES



SMD Active | *SMD* | *2.5 mm Subminiature* | *3.5 mm Compact* | *5 mm Miniature* | *4 mm* | *6/32 Thread Monolithic*

DIFFERENTIAL PROBE/ PAGE INDEX

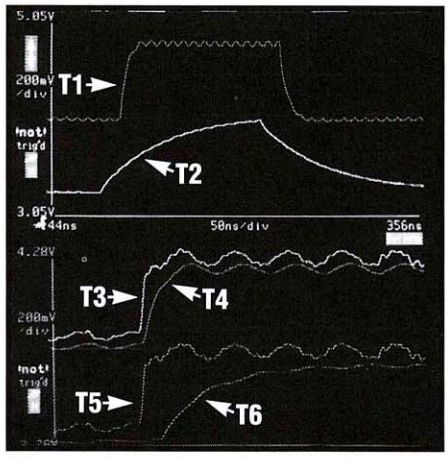
Probe	Page
P6046	**451**
P6246 w/1103	**451**
P6247	**496**
ADA400A	**498**

Active Probes
FET Voltage Probe Tutorial

Features

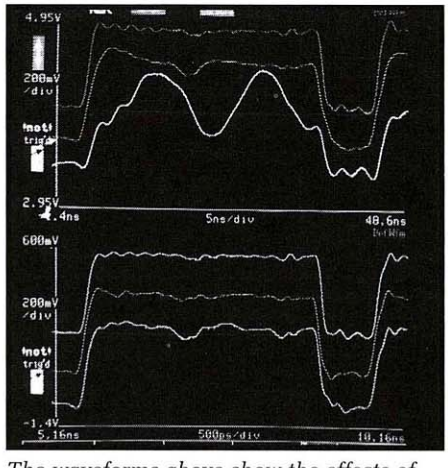
DESIGNED FOR:

- Digital Design and Debug of Logic Families Such As:
  - ECL
  - GaAs
  - MOS: CMOS; FastCMOS; BiCMOS
  - TTL
- Component Characterization/Measurement of High-speed Analog Circuitry Relative to:
  - Amplitude Levels
  - Aberrations
  - Propagation Delay and Timing
  - Bandwidths and Rise Times



The waveforms above show impedance test points of 50 Ω and 1 kΩ as probed with:

- *A 1X Passive probe [trace T1 (50 Ω), trace T2 (1 kΩ)]*
- *A 10X Active FET probe [trace T3 (50 Ω), trace T4 (1 kΩ)]*
- *A 10X Passive probe [trace T5 (50 Ω), trace T6 (1 kΩ)]*



The waveforms above show the effects of ground lead inductance. The top three traces show how the displayed waveform changes as the passive probe's ground lead length is increased from 1/2 in. (top trace) to 6 in. to 12 in. (bottom trace). The bottom three traces show how an active probe's waveform remains relatively unchanged, regardless of ground lead length, using the same ground lead sequence as the passive probe in the top three traces.

Choosing an Active Probe

Today active probes achieve higher performance than their predecessors and their high impedance passive counterparts. They provide:

EASY USE

- **Integral Probe Power** from compatible instrumentation.
- **Scope AutoCal*1** which compensates for probe offsets and drift.
- **Readout Encoding** accounts for probe attenuation factor and reduces measurement reading errors.
- **Auto Termination** eliminates the need to manually terminate the system (TEKPROBE® models).
- **Wide Linear Dynamic Range** allows access to today's logic voltage levels.
- **Variable DC Offset** allows correction for DC levels, to bring the signal into the probe's linear dynamic range. Probe Offset is controlled by a compatible instrument, or externally by the probe itself.

TRUER SIGNAL REPRODUCTION AND FIDELITY

- **Ultra-Low Input Capacitances and High Input Resistances** allow making measurements at unknown impedance test points by maintaining higher probe input impedance across a wider bandpass and reduce ground lead loop effects allowing the use of longer ground leads than a standard passive probe.
- **DC up to 4 GHz Bandwidths** allow improved AC and DC signal characterization and testing.

SERVICE, DURABILITY AND RELIABILITY

- **1 Year Warranty**
- **Gold-Plated Replaceable Probe Tips** (Replaceable except P6207/P6217) improve electrical connections and reliability and they lower maintenance costs.

**1 11000;TDS 400/500/600/700 Series.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Active Probes

FET Voltage Probe Tutorial

GUIDE TO CHOOSING AN ACTIVE PROBE

WHEN YOU HAVE	WHAT YOU NEED	WHY
Source impedance; >100 Ω and/or low power circuits	Any active probe with greater than 100 kΩ and <2 pF depends on the instrumentation interface, the frequency range and the sensitivity required.	Active probes maintain a higher input impedance throughout their frequency range. The low input C and high input R combination allows the acquisition of the fastest rise times and accurate amplitude measurements and provides less signal drain than a conventional passive probe.
Small signal circuit analysis	P6201 with its 1X sensitivity or P6217, P6245, P6243, P6204 and P6205 with 11 K high resolution mode.	Unity gain (1X) allows full sensitivity without bandwidth loss and maintains signal amplitude of small signals.
Characterization of circuits >350 MHz	The use of active probes or 50 Ω divider probes is recommended. The specific model depends upon the frequency and measurement response required.	Low input C, 50 Ω divider probes provide excellent rise time and propagation delay measurements; however, active probes provide better overall circuit analysis capabilities (amplitudes, rise times, propagation delay, aberrations, etc.).
Tuned circuits: Oscillators, tank circuits, etc.	P6217, P6207, P6245, P6243, P6201, P6204 dependent upon the frequency and measurement response required.	Low input C and high input R minimize circuit disturbance by reducing any additional impedance to the circuit.
General purpose circuit characterization and trouble-shooting where the circuit under test impedance is unknown or not easily calculated, and/or access to circuit ground is several inches away.	The P6243 and P6245 active probes provide low input C, high input R, durability and a budget price.	Low input C and the high input R provide truer signal fidelity for unknown or uncalculated impedance points. Lower input Cs also provide a higher ring frequency than passive probes, allowing the use of longer grounds.

Probe Type	Cable Length in meters	Attenuation	Bandwidth at –3dB in MHz	Input C in ≤pF	Input R in Ω	Linear Dynamic Range in Volts	DC Offset Range in Volts	Maximum Voltage in Volts (DC + pk AC)	Interface/ Readout/ Identify*2	Recommended Instrument
P6201	1.8	1X 10X 100X	900 900 900	3 1.5 1.5	100 k 1 M 1 M	±0.6 ±6.0 ±60	±5.6 ±56 ±200	±56 ±200 ±200	BNC/Y/N BNC/Y/N BNC/Y/N	400/2400/ 7000 Series*3
P6202A	2	10X 100X*1	500 500	2 2	10 M 10 M	±6.0 ±60	±55 ±200	±200 ±200	BNC/Y/N BNC/N/N	400/2400/ 7000 Series *3
P6204	1.5	10X	1000	1.9	10 M	±10	±15	±40	TPB/Y/Y	11000*4 TDS 400*5/ 500/600/700
P6205	1.5	10X	750	2	1 M	±10	NA	±40	TPB/Y/N	11000*4 TDS 400*5/ 500/600/700
P6207	1.6	10X	4000	0.4 (typical)	100 k	±4.0	±5.0	±40	TPS/Y/N	TDS 820
P6217	1.5	10X	4000	0.4 (typical)	100 k	±4.0	±5.0	±40	TPB/Y/N	11000*4 TDS 400*5/ 500/600/700
P6243	1.3	10X	1000	≤1	1M	±8.0	N/A	±40	TPB/Y/N	11000*4 TDS 400*5/ 500/600/700
P6245	1.3	10X	1500	≤1	1M	±8.0	±10.0	±40	TPB/Y/N	11000*4 TDS 400*5/ 500/600/700

*1 *Optional Accessory. Order 010-0384-00.*
*2 *Interface/Readout/Identify-AutoProbe Code: (TPB=TEKPROBE BNC)/(TPS=TEKPROBE SMA)/(BNC=Conventional BNC)/(Y=Yes)/(N=No).*
*3 *Requires Probe Power connector on the scope or recommended power supply.*
*4 *11000 Series = 11A32/11A34/11A52/11A71/11A81 in a compatible mainframe, i.e., DSA 600/CSA 400/11400, etc.*
*5 *DC Offset Functions are not incorporated into the older TDS 400 Series.*

Active Probe for SMDs

P6243 • P6243S • P6245

Features

P6243

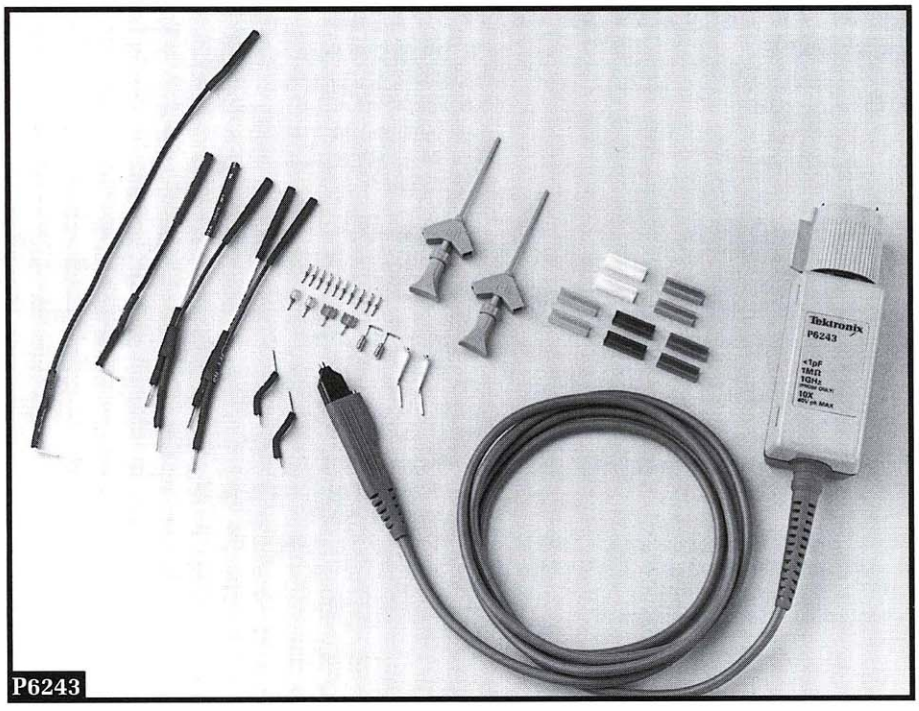
- ≤1 pF Input Capacitance
- 1 GHz Bandwidth (probe only)
- 1 MΩ Input Resistance
- Direct Access to SMDs as Small as 0.5 mm Pitch
- Measures CMOS, BiCMOS, ECL, GaAs and TTL logic
- Low Mass Probe Head/Cable
- No Additional Power Supplies or Cables Are Required with TEKPROBE® BNC Interface

P6245

- ≤1 pF Input Capacitance
- ≥1.5 GHz Bandwidth (Probe Only)
- 1 MΩ Input Resistance
- Direct Access to SMDs as Small as 0.5 mm Pitch
- Measures CMOS, BiCMOS, ECL, GaAs and TTL logic
- Low Mass Probe Head/Cable
- No Additional Power Supplies or Cables Are Required with TEKPROBE BNC Interface

Applications

- High-speed Digital Systems Design
- Component Design/Characterization
- Educational Research
- Manufacturing Engineering and Test



P6243

1 GHz Active Probe for SMDs for TEKPROBE BNC Interfaces

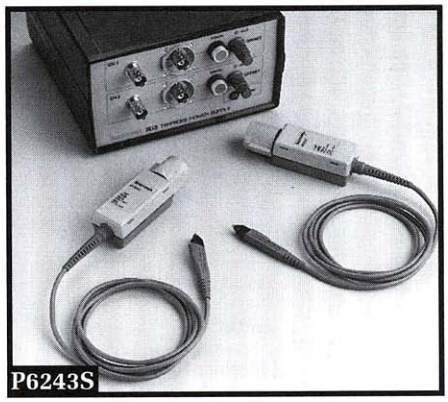
P6243

The P6243 Active FET probe is the high performance probing solution for 500 MHz Digital Storage Oscilloscopes. The P6243 has a probe only bandwidth of 1 GHz and will provide a 500 MHz system bandwidth when used with Tektronix' full line of 500 MHz DSOs. In addition, the P6243 is powered by the TEKPROBE BNC interface, eliminating the need for additional power supplies and cables when used with TEKPROBE BNC oscilloscopes.

The P6243 offers superior signal acquisition on surface mount devices compared to the much higher capacitive loading of passive probes. The P6243 has ≤ 1 pF capacitive loading which allows it to measure high speed signals without affecting the signal or device under test. Furthermore, the included accessories and adapters allow for easy attachment to SMDs.

P6243S

The P6243S is the ideal package for using the P6243 on non-TEKPROBE BNC oscilloscopes. The P6243S consists of 2 P6243 probes and the 1103 TEKPROBE Power Supply. This provides the full performance of the P6243 (except automatic scale factor readout) on any oscilloscope, including Tektronix' TDS300 Series and 2400 Series oscilloscopes.


P6243S

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

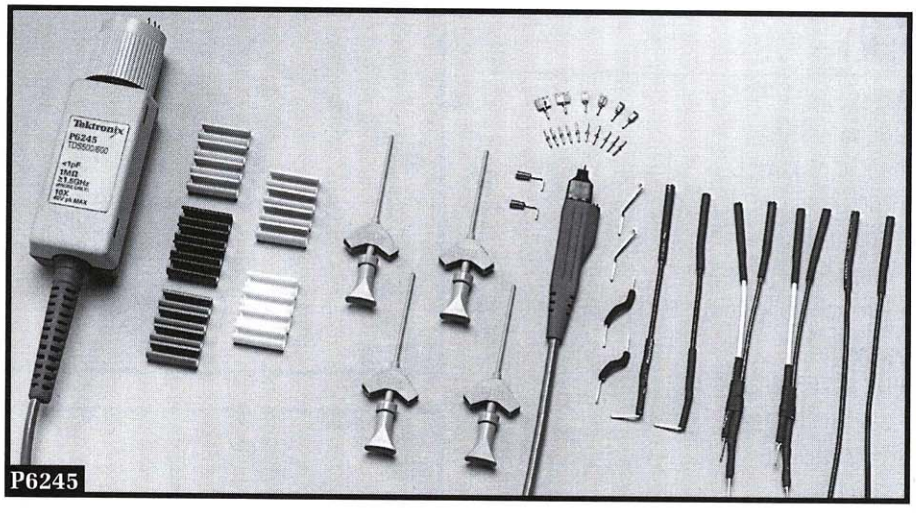
Active FET Probe for SMDs

P6243 • P6243S • P6245

P6245 Active FET Probe for TEKPROBE® BNC Interfaces

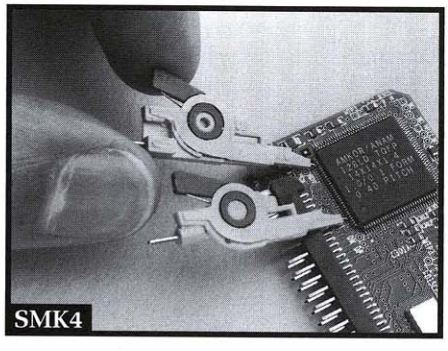
The P6245 Active FET probe provides the electrical and mechanical performance required for today's digital systems designs. The P6245 achieves high-speed signal acquisition by solving three traditional problems:

- Lower DUT loading (≤1 pF/1 MΩ probe loading)
- Direct and easy access to SMDs (Small compact probe head and versatile attachment accessories allow direct connection to the DUT.)
- Access DUT signals at scope bandwidth (P6245 Active FET Probe provides scope bandwidth at the probe tip for the TDS 684 and TDS 784 Series.)



CHARACTERISTICS

Probe Type	Cable Length	Attenuation	Bandwidth in GHz (Probe Only)	Rise Time	Input C in pF	Input R in Ω	Linear Dynamic Range	DC Offset Range	Max Voltage (Non-destruct)	Propagation Delay
P6243	1.3	10X	1.0	350 ps	<1 pF	1M	±8V	N/A	±40	5.3 ns ±200 ps
P6245	1.3	10X	1.5	267 ps	<1 pF	1M	±8V	±10 V	±40	5.3 ns ±200 ps



ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6243S
Active Probe System.
Includes: Two each P6243 Active Probe, 1 each 1103 TEKPROBE Power Supply.

P6243
Active Probe.
Includes: Two each: 50 mil, 25 mil (0.65 mm), and 0.5 mm SureFoot Adapters; 10 each Solderable Probe Tips; 2 each 1 in., 1 each 3 in. and 6 in. Ground Leads; 1 each Y Lead Adapters; 4 each SMT KlipChip™; 2 each of 5 colors, Cable Markers; 2 each Spring Adapter: Right Angle; and Instruction Manual.

P6245
Active FET Probe.
Includes: Two each: 50 mil, 25 mil (0.65 mm), and 0.5 mm SureFoot Adapters; 10 each Solderable Probe Tips; 2 each 1 in., 3 in., and 6 in. Ground Leads; 2 each Y Lead Adapters; 4 each SMT KlipChip™; 2 each of 5 colors, Cable Markers; 2 each Spring Adapter: Right Angle; and Instruction Manual.

RECOMMENDED ACCESSORIES
See 486 and 488.

POWER SUPPLY – TEKPROBE POWER SUPPLY
Order 1103.
See page 456 for complete selection information.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

SMD PROBING ADAPTERS*1
SureFoot® Adapters –
50 mil pitch. Order SF501.
25 mil and 0.65 mm pitch. Order SF502.
0.5 mm pitch. Order SF503.

SMK4 Micro KlipChip™ Adapter – 0.5 mm pitch. Order SMK4.

**1 See pages 474 to 477 for complete SMD Adapters information.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Active FET Probes

P6217 • P6205 • P6204 • 1103

Features

P6217
- DC to 4 GHz
- ≤0.40 pF Input C
- 100 kΩ Input R
- DC Offset
- Small Size
- Integral Probe Power TEKPROBE® BNC

P6205
- DC to 750 MHz
- 2 pF Input C
- 1 MΩ Input R
- Low Price
- Integral Probe Power TEKPROBE BNC

P6204
- DC to 1 GHz
- 1.9 pF Input C
- 10 MΩ Input R
- DC Offset
- Identify Button
- Integral Probe Power TEKPROBE BNC

1103
- Powers up to Two Probes
- For Use with P6203, P6204, P6205, P6217, P6243, P6245 on Non-TEKPROBE Interfaced Scopes
- Overload Protected

Applications

- High-speed Digital Systems Design
- Component Design/Characterization
- Educational Research
- Manufacturing Engineering and Test

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

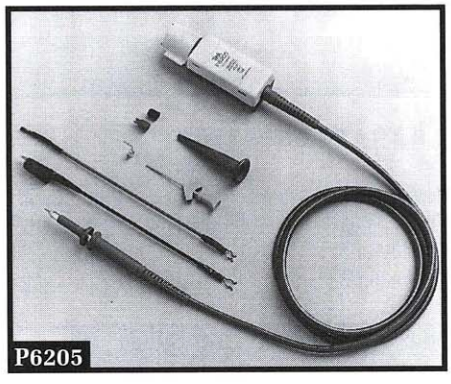
See Tektronix on the World Wide Web: http://www.tek.com

CE *(1103 only)*

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

P6217

P6204


P6205

1103

Active FET Probes for TEKPROBE BNC Interface

The P6204, P6205 and P6217 Probes are Tektronix' line of Low Circuit Loading Signal Acquisition probes for CSA (Communications Signal Analyzers), DSA (Digitizing Signal Analyzers), 11000 Series and the TDS Family of Oscilloscopes.

The P6204, P6205 and P6217 are designed with FET devices for their inputs, which allows very high input resistance values and low input capacitances.

The P6217 provides the widest bandwidth and lowest input capacitance for a handheld active voltage probe with 100 KΩ input resistance.

The P6204 provides wide bandwidth, with low input capacitance and the highest input resistance available. At the same time the P6204 is the only active FET probe available which provides remote control capabilities.

The P6205 provides low input capacitance and high input resistance performance at a budget price.

All three Active FET probes provide a wide linear dynamic input range for accessing most digital device families using today's logic voltage levels.

Power for the P6204, P6205 and P6217 is supplied by the CSA, DSA, TDS and 11000 Series mainframes through the TEKPROBE BNC Interface, eliminating the need for extra cabling and/or external power supplies.*[1]

A variable DC Offset function, which is controlled through the mainframe (CSA, DSA and 11000 Series) to bring signals (those within the offset control range) into the dynamic range of the probe, is available for the P6204 and P6217 probes.

Probe information such as type, serial number, attenuation factor, offset scale factor, input resistance, and termination resistance required is communicated through the TEKPROBE Interface between the Active Probe and the CSA, DSA and 11000 Series mainframes. This information is used by these oscilloscope mainframes during the scope initialization sequence and measurement analysis.

Active FET Probes

P6217 • P6205 • P6204 • 1103

Remote Control of several 11000 Series Programmable Functions/Actions is possible using the "Identify Button" on the P6204 probe head. These functions include Autoset, recall the next in a series of stored setups, invoke Automatic-Measurement, issue an SRQ (service action request), or activate the trace identification function.

These Active Probes may also be used with 50 Ω or 1 MΩ oscilloscope systems, with conventional BNC interfaces, via the Tektronix 1103 TEKPROBE® Power Supply. The 1103 has dual TEKPROBE inputs, dual BNC signal outputs, and dual voltage offset on/off switches and potentiometers.

BENEFIT HIGHLIGHTS

- **Low Input C, High Input R –** Minimizes circuit under test loading.
- **Probe Power Directly from CSA, DSA,TDS or 11000 Series TEKPROBE BNC Interfaces –** Means no additional cables or power supplies required.*1
- **Variable DC Offset (Except P6205) –** Allows correction for DC levels to bring the signal into the probe's dynamic measurement range.
- **Readout Coding for 10X Attenuation –** Reduces confusion and errors in measurement readings.
- **Gold-Plated Replaceable Probe Tips (Except P6217) –** Improved electrical connections and lower maintenance costs.
- **Miniature Size Accessories (Except P6217) –** Provides wide range of circuit attachments.
- **UL Listed –** Third party certification for safe operation.

DESIGNED FOR:

- Digital design and debug of logic families such as:
  - ECL
  - GaAs
  - MOS: CMOS; FastCMOS; BiCMOS; TTL
- Component characterization/measurement of high-speed analog circuitry relative to:
  - amplitude levels
  - aberrations
  - propagation delay and timing
  - bandwidths and rise times

**1 To use these TEKPROBE BNC Interface Probes on the 11800 or CSA 800 Series requires an 1103 TEKPROBE Power Supply, an SMA Male to BNC Female adapter, and a 50 Ω BNC cable.*

CHARACTERISTICS

Probe Type	Nominal Cable Length in meters	Attenuation	Bandwidth at –3 dB in MHz	Input C in pF	Input R in Ω	Linear Dynamic Range in Volts	DC Offset Range in Volts	Max. Voltage in Volts (DC + pk AC)	Interface/ Readout/ Identify*2	Recommended Instrument
P6204	1.5	10X	1000	1.9	10 M	±10	±15	±40	TPB/Y/Y	11000 *3
P6205	1.5	10X	750	2	1 M	±10	NA	±40	TPB/Y/N	11000 *3 TDS 400*4
P6217	1.5	10X	4000	0.40 Typical	100 k	±4.0	±5.0	±40	TPB/Y/N	TDS 500 TDS 600/TDS 700

**2 Interface/Readout/Identify Code: (TPB=TEKPROBE BNC)/(TPS=TEKPROBE SMA)/(BNC=CONVENTIONAL BNC)/(Y=Yes)/(N=No).*
**3 11000 SERIES = 11A32/11A34/11A52/11A71/11A72/11A81.*
**4 P6204, P6217, and P6245 DC Offset functions are not incorporated into the TDS 400 Family.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6204
10X, 1 GHz Active FET Probe.
Includes: Retractable Hook Tip (013-0107-07); 6 in. Ground Lead with Alligator (196-3120-00); 6 in. Ground Lead with Square-pin Receptacle (196-3198-01); Ground Contact, Spring (214-4125-00) SMT KlipChip™ (206-0364-00); Insulating Ground Cover (166-0404-01); IC Test Tip; Carrying Case; Instruction Manual (070-6949-00).

P6205
10X, 750 MHz Active FET Probe.
Includes: Same as P6204 except Instruction Manual (070-8202-00).

P6217
4 GHz Active FET Probe.
Includes: 4-post ECB Mount Ground Socket (131-5308-00); Edge Tab Ground Socket (131-5309-00); 2 each of 5 Lengths Wire-form Ground (131-5482-00); 1 Electrostatic Protection Cap (200-3961-00); 1 Adjustable Anti-static Wrist Strap (006-3415-04); Storage Cabinet; Instruction Manual (070-8553-00).

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

1103
TEKPROBE Power Supply.
For P6203, P6204, P6205, P6217, P6245 and P6231 and P6700 Series. Powers 2 Probes.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5 – Available.
See the General Customer Information Section for description.

ADDITIONAL ACCESSORIES (FOR 1103)
36 In. Precision 50 Ω BNC cable – Order 012-0482-00.
50 Ω Feedthrough Termination – Order 011-0049-01.

RECOMMENDED ACCESSORIES FOR P6204, P6205, P6217

See pages 481 and 486.

Probe Tip Adapter – For P6207, P6217 and SD-14 Active Probes. Instruction Sheet Plus SMA Male 50 Ω Termination provided.Order 013-0271-01.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(1103 only)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Active FET Probes

P6201 • P6202A • 1101A

Features

FOR 50 Ω AND 1 MΩ INTERFACES

P6201

- True Signal Fidelity, DC up to 900 MHz
- 1.5 pF Input C*[1]
- 1 MΩ Input R*[1]
- 1X/10X/100X
- AC-DC Coupling
- Variable DC Offset, up to ±200 V
- Selectable 50 Ω, Termination for Use with 50 Ω or 1 MΩ Inputs

P6202A

- DC to 500 MHz
- 2 pF Input C
- 10 MΩ Input R
- 10X/Optional 100X
- AC-DC Coupling
- Variable DC Offset, up to ±200 V
- Selectable 50 Ω, Termination for Use with 50 Ω or 1 MΩ Inputs

1101A

- Powers up to Two Probes
- For Probe Use with Oscilloscopes That Do Not Have Probe Power
- Compatible with the P6201, P6202A, and P6230
- Overload Protected
- Variable DC Offset, up to ±200 V
- Selectable 50 Ω, Termination for Use with 50 Ω or 1 MΩ Inputs

[1] See specifications.

Applications

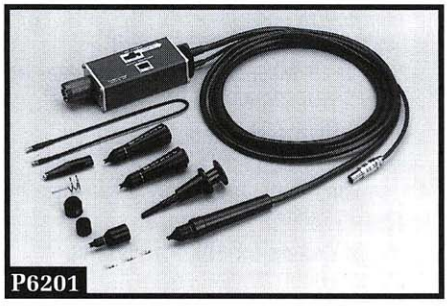
- Digital Design and Debug of Logic Families
- Component Characterization/Measurement of High-speed Analog Circuitry

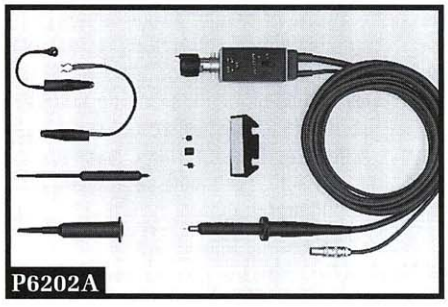
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(1101A only)*

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*


P6201


P6202A

P6201/P6202A

The P6201 and P6202A are Tektronix' line of Low Circuit Loading Active Signal Acquisition probes for 400 Series, 2400 Series, and 7000 Series Families of Oscilloscopes.

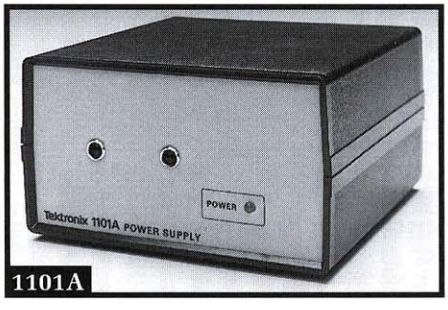
The P6201 and P6202A with Active FET devices in their inputs provide very high input impedances.

Both the P6201 and P6202A probes provide a wide linear dynamic input range for accessing most digital device families using today's logic voltage levels.

The P6201 provides unity gain (1X) and is the best general purpose FET probe within its voltage range. Plug-on attenuator heads provide wider dynamic ranges (10X and 100X), while maintaining the oscilloscope readout factor.

Wider dynamic input range for the P6202A is achieved by an optional 10X attenuator head which provides 100X attenuation.

Both the P6201 and P6202A probes provide a variable DC Offset function which is set via the offset controls on the probe's compensation box to bring signals (those within the offset control range) into the dynamic range of the probe.



1101A

AC or DC coupling selection is available on the P6201 and P6202A FET Probes. When AC coupled, the DC voltage component is blocked, allowing viewing of superimposed signals.

A self-contained selectable 50 Ω termination switch allows the P6201 or P6202A to be terminated into a 50 Ω or 1 MΩ oscilloscope inputs.

Power for the P6201 and P6202A is supplied by the 400 Series, 2400 Series, and 7000 Series mainframes through the optional Probe Power Jack, or the 1101A Power Supply.

The P6201 or P6202A may also be used with other 50 Ω and 1 MΩ input real-time oscilloscopes, sampling systems, spectrum analyzers and counters via the 1101A and appropriate interface adapters (SMA to BNC, GR to BNC, etc.).

The 1101A power supply provides external power to probes when the oscilloscope used does not have the capability to supply probe power.

The 1101A has two power receptacles that will power up to two independent probes, such as the P6201, P6202A, and P6230.

Active FET Probes

P6201 • P6202A • 1101A

DESIGNED FOR:

- Digital design and debug of logic families such as:
  - ECL
  - GaAs
  - MOS: CMOS; FastCMOS; BiCMOS
  - TTL
- Component characterization/measurement of high-speed analog circuitry relative to:
  - amplitude levels
  - aberrations
  - propagation delay and timing
  - bandwidths and rise times

P6201, P6202A, 1101A

CHARACTERISTICS

Probe Type	Nominal Cable Length in meters	Attenuation	Bandwidth at –3 dB in MHz	Input C in pF	Input R in Ω	Linear Dynamic Range in Volts	DC Offset Range in Volts	Maximum Voltage in Volts (DC + pk AC)	Interface/ Readout/ Identify*1	Recommended Instrument
P6201	1.8	1X	900	3	100 k	±0.6	±5.6	±100	BNC/Y/N	400/2400/ 7000 Series*2
		10X	900	1.5	1 M	±6.0	±56	±200	BNC/Y/N	
		100X	900	1.5	1 M	±60.0	±200	±200	BNC/Y/N	
P6202A	2	10X	500	2	10 M	±6.0	±55	±200	BNC/Y/N	400/2400/ 7000 Series*2
		100X*3	500	2	10 M	±60.0	±200	±200	BNC/Y/N	

*1 *Interface/Readout/Identify-AutoProbe Code: (TPB=TEKPROBE® BNC) / (TPS=TEKPROBE SMA) / (BNC=Conventional BNC) / (Y=Yes) / (N=No).*

*2 *Requires Probe Power connector on mainframe or 1101A Power Supply.*

*3 *Optional Accessory. Order 010-0384-00.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6201
1X, 900 MHz FET Probe.
Includes: Retractable Probe Tip (013-0135-00); 10X Attenuator Head (010-0376-00); 100X Attenuator Head (010-0377-00); 3 Probe Tips (206-0200-00); Miniature Probe Tip Adapter (103-0164-00); 12 in. Ground Lead (175-0848-02); Ground Contact (131-1302-00); Alligator Clip (344-0046-00); Electrical Insulating Sleeve (166-0557-00); Ground Contact Insulator (342-0180-00); Probe Holder (352-0351-00); Carrying Case; Instruction Manual (070-1306-02).

P6202A
10X, 500 MHz FET Probe.
Includes: Retractable Probe Tip (013-0097-01); 2 Alligator Clips (344-0046-00); Probe Holder (352-0351-00); 3 in. Ground Lead (175-0849-00); Probe Adjustment Tool (003-0675-01); 6 in. Ground Lead (175-1017-00); 2 Replaceable Probe Tips (206-0230-01); Electrical Insulating Sleeve (166-0404-01); Carrying Case; Instruction Manual (070-3642-00).

ADDITIONAL ACCESSORIES
Also see pages 486 and 488.

10X Attenuator – (P6202A only) For a total of 100X attenuation. Order 010-0384-00.

1101A Power Supply –
For P6201, P6202A. Powers 2 Probes.

INTERNATIONAL POWER PLUG OPTIONS (FOR 1101A)

Opt. A1 – Universal Euro, 220 V 50 Hz.

Opt. A2 – United Kingdom, 240 V 50 Hz.

Opt. A3 – Australian, 240 V 50 Hz.

Opt. A4 – North American, 240 V 60 Hz.

Opt. A5 – Switzerland, 220 V 50 Hz.

See General Customer Information Section for additional description.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(1101A only)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Active FET Probe

P6207

Features

P6207

- True Signal Fidelity
  - DC up to 4 GHz
- Ultra-low Input Capacitance
  - 0.4 pF Provides Lower Circuit Loading and the Use of Longer Ground Leads
- 100 kΩ Input Resistance
  - Maintains Circuit Biasing Levels
- Easy to Use
  - Active Performance with Passive Simplicity
- Variable DC Offset ±5 V
- Integral Probe Power TEKPROBE® SMA
- Small Geometry Accessibility

Applications

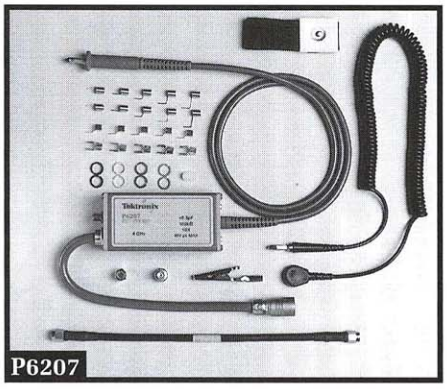
- Digital Design and Debug of Logic Families Such as ECL, GaAs, MOS (CMOS; FastCMOS; BiCMOS), TTL
- Component Characterization/Measurement of High-speed Analog Circuitry Relative to:
  - Amplitude Levels
  - Aberrations
  - Propagation Delay and Timing
  - Bandwidths and Rise Times

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.



P6207 Active FET Probe For TEKPROBE SMA Interfaces

The P6207 Active (FET) Probe is a Low Circuit Loading Signal Acquisition probe for TDS820 Oscilloscopes.

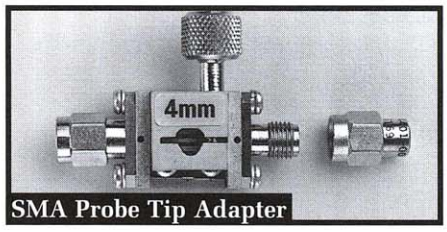
The P6207 provides the widest bandwidth and lowest input capacitance at 100 kΩ available for a handheld active voltage probe.

The P6207 provides a wide linear dynamic input range for accessing most digital device families using today's logic voltage levels.

The P6207's lower input capacitance reduces the AC current flow and the sensitivity to ground loops, thereby easing ground lead length requirements.

BENEFIT HIGHLIGHTS

- **Low Input C, High Input R –** Minimizes circuit under test loading.
- **Probe Power Directly from TDS800 Series TEKPROBE SMA Interfaces –** Means no additional cables or power supplies required.
- **Variable DC Offset –** Allows correction for DC levels to bring the signal into the probe's dynamic measurement range.
- **Readout Coding for 10X Attenuation –** Reduces confusion and errors in measurement readings.
- **Gold-Plated Probe Tips –** Improved electrical connections.
- **UL Listed –** Third party certification for safe operation.



PROBE TIP ADAPTER

The Probe Tip Adapter is a high-performance 50 Ω "T" type pickoff for use with high impedance Tektronix P6207 or P6217 Active FET probes, the Tektronix SD-14 Sampling Head and other probes compatible with the 4 mm probe tip system. The in-line portion of the "T" is fitted with SMA-compatible 2.92 mm connector, one end male and one end female. The signal pickoff point is a receptacle for the Probe Tip. An SMA male 50 Ω termination is included.

When used with the P6207 or P6217, the Probe Tip Adapter allows signal pickoff from a 50 Ω system with a minimum of disturbance of the system characteristics. This provides a convenient means of obtaining a signal for the P6207 or P6217 from a closed coaxial 50 Ω system.

P6207 Characteristics

Nominal Cable Length in meters – 1.6.

Attenuation – 10X.

Bandwidth at –3dB in MHz – 4000.

Input C in pF – 0.4 Typical.

Input R in Ω – 100 k.

Linear Dynamic Range in Volts – ±4.0.

DC Offset Range in Volts – ±5.0.

Maximum Voltage in Volts (DC + pk AC) – ±40.

Interface/Readout/Identify*1 – TPS/Y/N.

Recommended Instruments – TDS820.

**1 Interface/Readout/Identify-AutoProbe Code: (TPB=TEKPROBE BNC)/(TPS=TEKPROBE SMA)/(BNC=Conventional BNC)/(Y=Yes)/(N=No).*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6207
4 GHz Active FET Probe, SMA.
Includes: 1 RF Cable Assembly, 8.5 in. (174-1120-00); 4-post ECB Mount Ground Socket (131-5308-00); Edge Tab Ground Socket (131-5309-00); 2 each of 5 Lengths Wire-form Ground (131-5482-00); 1 Electrostatic Protection Cap (200-3961-00); 1 SMA Shorting Connector (015-1021-00); 1 Adjustable Anti-static Wrist Strap (006-3415-04); Storage Cabinet; Instruction Manual (070-7909-00).

RECOMMENDED ACCESSORIES
See page 481.

Probe Tip Adapter – For P6207, P6217, SD-14. Active Probes. Instruction Sheet plus SMA Male 50 Ω Termination Provided (015-1022-00). Order 013-0271-01.

50Ω Divider (Zo)

P6150 • P6156

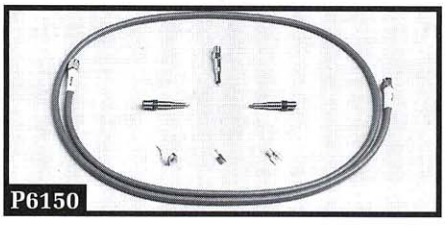
Features

LOW IMPEDANCE ZO TDR PASSIVE PROBES

- P6150 to 9 GHz
- P6156 to 3.5 GHz
- Low Capacitive Loading to Extremely High Frequencies
- Interchangeable Attenuator Tip Assemblies: 1X, 10X (P6150); 10X, 20X, 100X (P6156)

Applications

- High-speed Device Characterization in Microwave Communication, Signal Processing, and Logic Applications
- Propagation Delays for ECL, GaAs and Other Logic Circuitry and Devices
- Circuit Board Impedance Testing (TDR)
- High-speed Sampling Systems

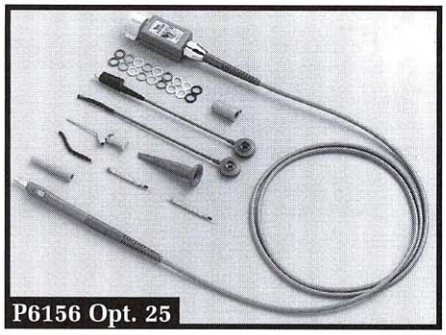

P6150

P6150 DC TO 9 GHz

The P6150 is a very high bandwidth, 10X attenuation, low impedance probe designed for use with the SD2X family of Sampling/TDR plug-ins. The probe consists of interchangeable, screw-in attenuator tip assemblies (1X and 10X) and an SMA-to-SMA probe cable. An assortment of circuit and grounding attachments is included to optimize attachment to the device under test while maintaining high signal integrity.

P6156 DC TO 3.5 GHz

The P6156 is a 3.5 GHz, low impedance Zo probe (50 Ω divider) which comes standard with a 10X (500 Ω) attenuator tip. The 100X attenuation value is available as an option, and the 10X, 20X, and 100X attenuators may be purchased as replaceable sub-assemblies. Although designed for the 11A52, 11A72, and 11A81, the P6156 probe may be used with 11000 Series plug-ins, the 11800 Series SD2X Sampling/TDR plug-ins, 7000 Series plug-ins and Sampling/TDR units, 2400 Series,


P6156 Opt. 25

TDS 400, 500, 600, 700 Series or other 50 Ω/1 MΩ input channel amplifiers and oscilloscopes (with the proper adapters). The 50 Ω Termination required by the P6156 is automatically sensed by 11000 Series mainframes and plug-ins.The P6156 may be directly connected to a 50 Ω input, but requires a 50 Ω termination when used with 1 MΩ amplifiers. This probe gives you a handy identify button for accessing many of the functions of your 11000 or DSA600 Series scopes from the probe. The attenuator tips are color-coded to a switch on the compensation box of the P6156 to help in properly setting the readout scale factor.

Note: The P6156 attenuator tip must be changed and the compensation box readout switch changed to provide the various 1X, 10X, 20X, and 100X attenuation values. Tip colors match switch setting colors.

CHARACTERISTICS

Probe Type	Nominal Length	Attenuation	Bandwidth	Rise Time	Loading Input R/C	Max V In	Propagation Delay
P6150	1 m	10X ±2%	9 GHz	<38.8 ps	500 Ω/<0.15 pF	12.5 V RMS	4.40 ns ±0.1 ns
		1X ±2%	≥3 GHz	≤170 ps	50 Ω/N/A	*1	4.40 ns ±0.1 ns
P6156	1.5 m	10X ±3%	≥3.5 GHz	<100 ps	500 Ω/≤1 pF	15 V RMS	7.75 ns ±0.07 ns
		100X ±3%	≥3.0 GHz	≤120 ps	5000 Ω/≤1.1 pF	50 V RMS	7.75 ns ±0.07 ns
		20X ±3%	≥3.5 GHz	<100 ps	1000 Ω/≤1 pF	22 V RMS	7.75 ns ±0.07 ns

Interface/Readout/Identify: Interface: B=BNC; S=SMA
Readout/Identify: Y=Yes; N=No

**1 Limited by scope input or 42 V RMS.*
**2 Limited by scope input or 50 V RMS.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6150
10X, 9 GHz, 1.0 m, Low Impedance Probe.
Includes: One 1X Attenuator Head (206-0398-00); Two 10X Attenuator Heads (206-0399-03); 1.0 m Cable Assembly (174-1341-00); Instruction Sheet (070-7173-00); and 1 Accessory Kit consisting of: 20 each Ground Clip, 3 each Adjustable Ground Lead, 10 each Electrical Contact, and 2 each Probe to Circuit Board Ground Connectors (020-1708-00).

ADDITIONAL ACCESSORIES
See pages 481 and 484.

SMA Male to BNC Female – Order 015-0554-00.
SMA Female to BNC Male – Order 015-0572-00.
SMA to Probe Tip – (For P6156 only) Order 013-0237-00.

P6156
3.5 GHz (10X), 1.5 m Low Impedance Probe.
Includes: 10X Attenuator Head (206-0380-00); 6 in. Ground Lead with Alligator Clip (196-3305-00); Retractable Hook Tip (013-0107-07); 2 in. Ground Lead (195-4240-00); 6 in. Ground Lead (196-3113-02); Ground Collar (343-1003-01); SMT KlipChip™ (206-0364-00); 2 each Cable Markers, various colors: gray, white, green, red; Probe Tip Holder (352-0670-00); Instruction Sheet (070-6430-00).

Opt. 25 – Adds 100X Attenuator.

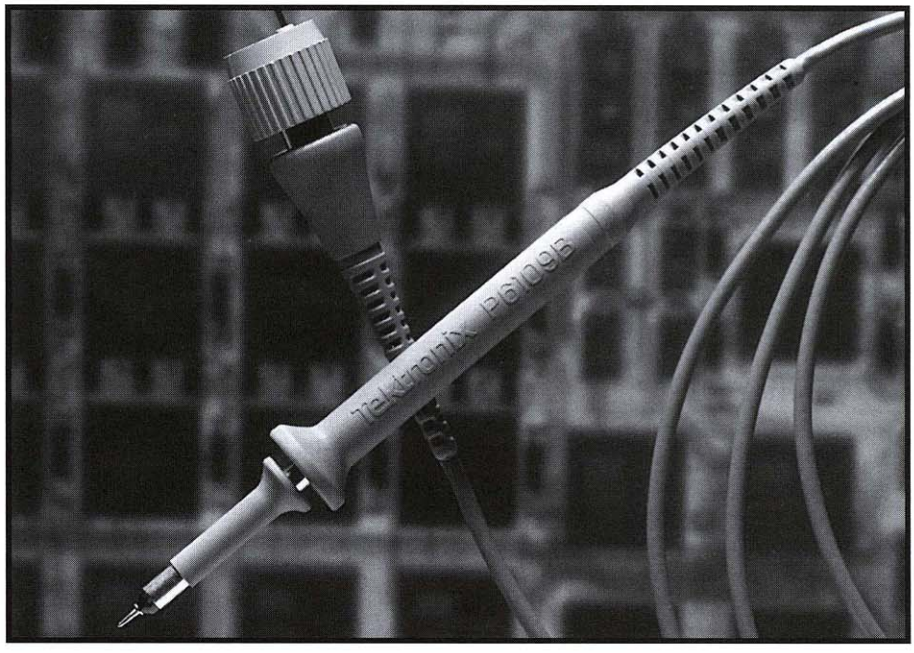
Probe Tips – For P6156 only.
(10X) Order 206-0380-00.
(20X) Order 206-0381-00.
(100X) Order 206-0382-00.

Passive Voltage Probes

Features

PASSIVE VOLTAGE PROBES

- Every Scope Needs at Least a Pair of General Purpose Probes



Tips on Selecting Probes

Nearly all general purpose and laboratory oscilloscopes use probes to make a direct, flexible and convenient connection to a device-under-test (DUT). Of all the different types of measurements, voltage measurements top the list by a wide margin. The ideal probe/oscilloscope combination should acquire the signal and truly represent it on the display without changing the signal source.

CONSIDER YOUR SCOPE'S...

- **Bandwidth?** Select a probe with equal or better bandwidth.
- **Input capacitance?** Select a probe with a compensation range covering the scope's nominal input capacitance.
- **Readout feature support?** Select a probe that provides automatic coding for scale factor.
- **Input loading?** Standard passive probes support 1 MΩ inputs. 50 Ω probes are also available in passive and active (FET) styles.

CONSIDER YOUR APPLICATION...

- **Engineering and design –** High frequency, specialty, absolute measurements.
- **Service –** Mixture of high and low frequency, specialty and general purpose, absolute and relative measurements.
- **Manufacturing –** Low frequency, general purpose, relative measurements.

CONSIDER YOUR MEASUREMENTS . . .

- **How will probe loading affect your measurements?** High resistance probes (10 MΩ) give minimum amplitude error; however, any significant tip capacitance will degrade the leading edge.
- **What is the waveform rise time?** Passive probes work in conjunction with the scope's input circuitry to provide a system bandwidth.
- **What is the peak voltage?** Passive probes typically have 420 V peaks. High voltage probes can handle 1.5 kV to 40 kV.
- **What is the waveform amplitude?** Maximum input voltage for a passive probe is stated as DC pulse peak AC. This is also the maximum safe input before electrical damage occurs.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

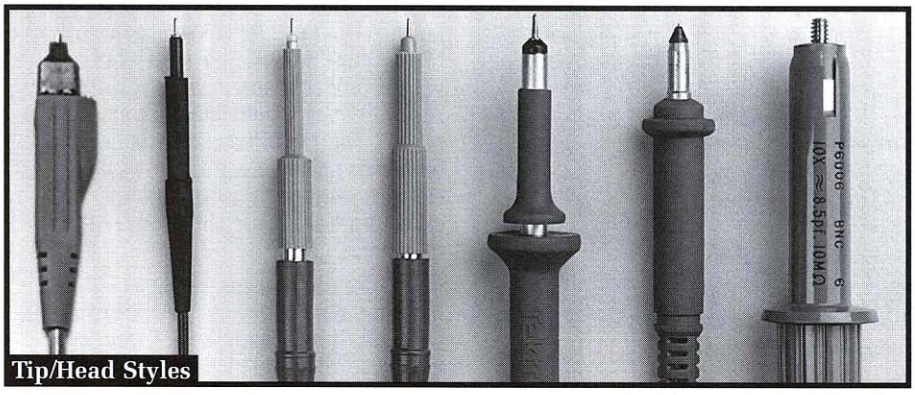
Tektronix Measurement products are manufactured in ISO registered facilities.

Passive Voltage Probes

CONSIDER YOUR MECHANICAL REQUIREMENTS...

- **Probe size?** Small probes are easier to handle and attach to test points. Larger probes are more durable.
- **Tip type?** Probe tip durability is affected by materials and design. Tektronix' most durable configuration for passive voltage probes is the miniature type which is supported by a wide variety of tip accessories for test point connection. The compact probe configuration offers improved electrical performance. Subminiature probe types are useful for probing high density circuitry where several probes have to be attached in close proximity.
- **Environmental conditions?** Probes are expected to be exposed to harsh conditions in the field, but often overlooked are the rigors of daily use and abuse that general purpose probes are most likely to experience.

TIP/HEAD STYLES



SMD Active *SMD* *2.5 mm Subminiature* *3.5 mm Compact* *5 mm Miniature* *4 mm* *6/32 Thread Monolithic*

Passive Voltage Probes

P6101B • P6103B • P6109B • P6111B • P6112 • P6114B • P6117 • P6119B • P6129B

Features

B-SERIES 1 MΩ INPUTS

P6101B
- 1X, 15 MHz

P6103B
- 10X, 60 MHz

P6109B
- 10X, 100 MHz
- Readout

P6111B
- 10X, 200 MHz
- Readout

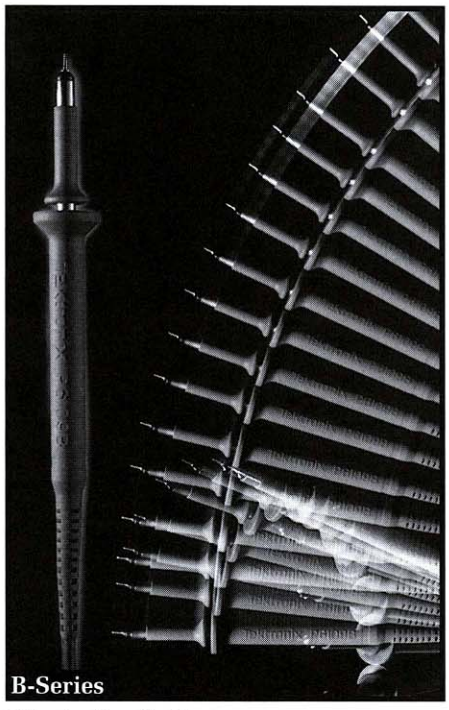
P6112
- 10X, 100 MHz

P6114B
- 10X, 400 MHz

P6117
- 10X, 200 MHz

P6119B
- 1X/10X
- 10 MHz/100 MHz

P6129B
- 1X/10X
- 10 MHz/100 MHz
- Readout



B-Series Family Photo.

B-Series Passive Voltage Probes

- Single piece, molded rubber body
- Lightweight ergonomic design
- 10 times improvement in durability
- HYBRID/SMT circuitry on multi-layer circuit board for improved performance and reliability
- New stronger replaceable probe tip
- UL safety certification
- 1 year unconditional guarantee
- Miniature probe tip compatible with a wide range of Tektronix accessories and adapters

Passive voltage probes are the most commonly used oscilloscope probe. Other specialty probes expand the range and functionality of an oscilloscope as a measurement system, but a general purpose, passive voltage probe is the working end of the oscilloscope, a tool used and abused every day without concern by engineers and technicians. The probe's utility is often taken for granted…that is, until it doesn't work. And then it's a scramble just to complete the simplest task.

Two years of customer research, design innovation, and an exhaustive test program resulted in a most remarkable family of oscilloscope probes. The B-Series of passive voltage probes is specifically designed for Tektronix' analog and digital portable oscilloscopes. The 1X, 10X and 1X/10X switchable probes combine the same high quality electrical performance that customers expect from Tektronix with a new rugged mechanical design.

A B-Series probe is encased in a resilient, molded rubber body and is virtually indestructible. It is lighter in weight, more comfortable to hold, and more reliable than modular probe styles. The probe's replaceable tip is designed to withstand up to 20 pounds of force. Patented integral strain relief allows complete freedom of movement while providing superior cable flex. Each probe has received UL safety certification and meets MIL-T-28800, Class 3, environment specifications – something portable scope users will appreciate.

PROBE/SCOPE COMPATIBILITY

Probe	Scope/Product
P6101B	All Scopes
P6103B	2201, 2205, 2212, 2214, 2225, TAS 220, TAS 250
P6109B	2211, 2221, 2224, 2230, 2232, 2235A, 2236A, 2245A, 2246A, 2247A, 2252, TAS 455, TAS 465, TAS 475, TDS 310, TDS 320, TDS 340, TDS 340A
P6111B	TAS 485, TDS 350, TDS 360
P6112	TDS 200
P6114B	TDS 380
P6117	THS 700
P6119B	2201, 2205, 2212, 2214, 2225, TAS 220, TAS 250
P6129B	2211, 2221, 2224, 2230, 2232, 2235, 2236A, 2245A, 2246A, 2247A, 2225, TAS 455, TAS 465, TAS 475, TDS 310, TDS 320, TDS 350, TDS 360, TDS380

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

(Except P6119B/P6129B)

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

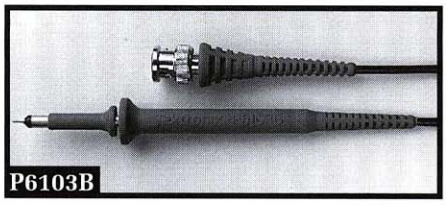
Tektronix Measurement products are manufactured in ISO registered facilities.

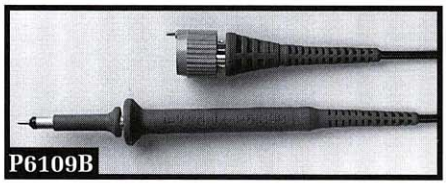
Passive Voltage Probes

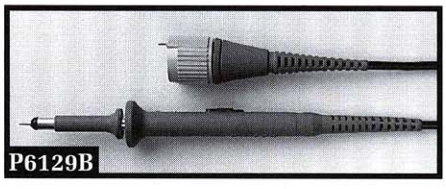
P6101B • P6103B • P6109B • P6111B • P6112 • P6114B • P6117 • P6119B • P6129B

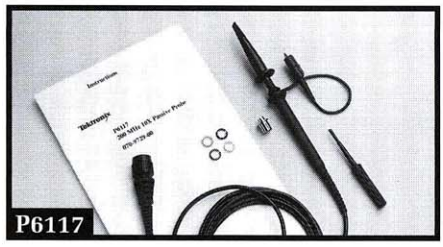
The P6101B, P6103B, P6109B, P6111B, P6112, P6114B, P6117, P6119B and P6129B probes are designed to complement Tektronix' family of portable DSO and ART instruments. The core of each probe's performance is supplied by a Tektronix HYBRID/SMT device. Tektronix' instrumentation experience provides an extra margin of quality and reliability to the B-Series that is not commonly available to probe manufacturers. B-Series probes have been designed and tested to support the overall system performance and measurement quality that Tektronix oscilloscopes guarantee.

Through the introduction of the B-Series, Tektronix has set a new standard for passive voltage probe styling, performance and durability.


P6103B


P6109B


P6129B


P6117

Standard Accessories

CHARACTERISTICS

Type	Attenuation	Bandwidth Megahertz (MHz)	Comp. Range Picofarads (pF)	System Input Resistance Megaohms (MΩ)	Typical Input C Picofarads (pF)	Maximum Voltage DC + pk AC (Volts)	Readout
P6101B	1X	15	NA	1	100	420	
P6103B	10X	60	15 to 35	10	13	420	
P6109B	10X	100	15 to 35	10	13	420	√
P6111B	10X	200	15 to 35	10	14	420	√
P6112	10X	100	15 to 35	10	13.3	300 V RMS	
P6114B	10X	400	10 to 35	10	14.1	300 V RMS	√
P6117	10X	200	15 to 35	10	13.3	300 V RMS	
P6119B	1X/10X	10/100	15 to 35	1/10	100/18	420	
P6129B	1X/10X	10/100	15 to 35	1/10	100/18	420	√

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6101B
1X, 15 MHz Passive Voltage Probe.
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-7819-03).

P6103B
10X, 60 MHz Passive Voltage Probe.
Includes: Same as P6101B except Instruction Manual (070-7847-02).

P6109B
10X, 100 MHz Passive Voltage Probe with Readout.
Includes: Same as P6101B except Instruction Manual (070-7849-02).

P6111B
10X, 200 MHz Passive Voltage Probe.
Includes: Same as P6101B except Instruction Manual (070-8543-01).

P6112
10X, 100 MHz Passive Voltage Probe.
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; BNC to Probe Tip Adapter; Adjustment Tool; Instruction Manual (070-9694-00).

P6114B
10X, 400 MHz Passive Voltage Probe.
Includes: Same as P6112 except Instruction Manual (070-9491-00).

P6117
10X, 200 MHz Passive Voltage Probe.
Includes: Same as P6112 except Instruction Manual (070-9729-00).

P6119B
1X/10X, 10/100 MHz Passive Voltage Probe.
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-8000-02).

P6129B
1X/10X, 10/100 MHz Passive Voltage Probe with Readout.
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-8547-02).

RECOMMENDED ACCESSORIES
See pages 486 to 487.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Passive Voltage Probes

P5102

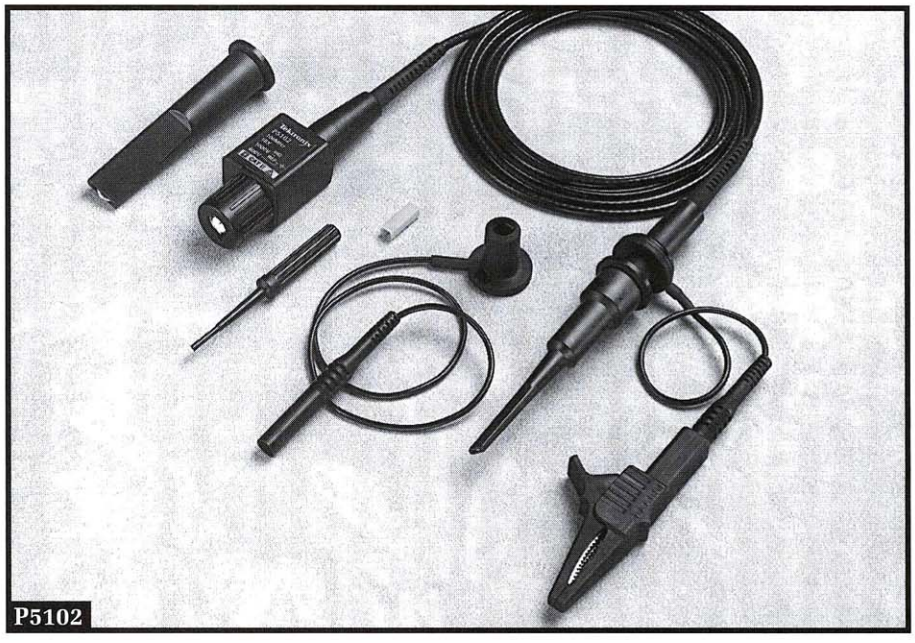
Features

P5102 – FOR THS 700 AND OTHER FLOATING CHANNEL APPLICATIONS

- 100 MHz Bandwidth
- Up to 1,000 V_{rms}
- 10X Attenuation
- IEC1010 and UL 3111-1 Certified

Applications

- Power Supply Design
- Motor Drive Design
- Electronic Ballast
- Power Semiconductors



IsolatedChannel™ Applications

In many applications, it is important to be able to isolate the measurement from earth ground and also to isolate the common voltage between channels. With the P5102 and the THS 700 Series handheld digital storage oscilloscope you have not only the isolation for the measurement from earth ground, but you also have full isolation between the two channels.

The P5102 was designed to give you this isolated channel performance for up to 1000 V AC RMS on the 100 MHz probe. A variety of screw-on accessories provides easy connection to the device under test.

Characteristics

Nominal Length – 2 m.
Attenuation – 10X.
Bandwidth – 100 MHz.
Rise Time – ≤3.5 ns.
Loading – 5 MΩ/11.2 pF.
Max Input V – 1000 V AC RMS.
Input C – 24 to 28 pF.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P5102
10X, High Voltage Probe for THS 700 Series.

Includes: Large Retractable Hook Tip, Small Retractable Hook Tip, 6 in. Common Lead, 18 in. Common Lead, Large Crocodile Clip, Colored Cable Markers, Adjustment Tool, Instruction Manual (070-9294-01).

Passive Voltage Probes

YT5100 • YT5060

Features

YT5100

- 1X/10X Attenuation
- 100 MHz Bandwidth
- 1.5 Meter Length
- UL 1244 Listed

YT5060

- 1X/10X Attenuation
- 60 MHz Bandwidth
- 1.5 Meter Length
- UL 1244 Listed

YT5100/YT5060

YT5100 and YT5060 Passive Voltage Probes

The YT5100 100 MHz and YT5060 60 MHz Passive Voltage Probes permit selection of 1X or 10X attenuation, using a switch located on the probe head.

Both probes are compatible with general purpose oscilloscopes having an input capacitance between 20 and 40 pF.

Characteristics

X10 POSITION

Bandwidth – DC: 100 MHz (YT5100), DC: 60 MHz (YT5060).

Probe Length – 1.5 m.

Attenuation Ratio – 10:1.

Compensation Range – 20 to 45 pF.

Input Capacitance – 16.6 pF.

Input Resistance – 10 MΩ.

Maximum Input Voltage – 500 V (DC + pk AC).

X1 POSITION

Bandwidth – DC: 5 MHz (YT5100), DC: 4 MHz (YT5060).

Probe Length – 1.5 m.

Attenuation Ratio – 1:1.

Compensation Range – All scopes with 1 MΩ input.

Input Capacitance – 110 pF.

Input Resistance – 1 MΩ.

Maximum Input Voltage – 250 V (DC + pk AC).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

YT5060
1X/10X, 60 MHz Passive Voltage Probe.
Includes: Retractable Hook Tip (013-0107-07), 6 in Ground Lead (196-3120-01), Instruction Manual (070-9323-00).

YT5100
1X/10X, 100 MHz Passive Voltage Probe.
Includes: Retractable Hook Tip (013-0107-07), 6 in Ground Lead (196-3120-01), Instruction Manual (070-9323-00).

RECOMMENDED ACCESSORIES
See pages 486 to 487.

Passive Voltage Probes

P6105A • P6106A • P6122

Features

FOR THE CLASSIC OSCILLOSCOPES

P6105A
- 10X, 100 MHz
- Readout
- UL 1244 Listed

P6106A
- 10X, 250 MHz
- Readout
- UL 1244 Listed

P6122
- 10X, 100 MHz
- UL 1244 Listed

P6106A

Modular Probes

During our first 40 years, Tektronix introduced many innovative oscilloscopes which established the standards for form and function that are still followed today. Technological gains have allowed performance improvements over time, but the basic look and feel established by Tektronix remains. Because of this, Tektronix scopes ten and even 20 years old are still being used. We call these the Classics. Some of these older instruments have special probe requirements. The passive voltage probes found on these pages are for oscilloscopes introduced prior to 1986.

Tektronix modular probes are designed to save you money in repair and maintenance over the life of the probe. The three modules, probe head, cable and connector quickly snap or screw together, eliminating the need for soldering. Spare modules can be ordered and stocked, reducing down-time and eliminating the need to send a probe in for repairs. Modularity, rugged construction and highly reliable hybrid circuitry make these Tektronix probes a cost effective probing solution.

Tektronix modular passive probes are used to acquire high fidelity signals from low source impedance circuits. Each probe, except the P6122, will automatically scale the readings on oscilloscopes equipped with the readout feature. In addition, these same probes provide a ground reference button on the probe head for quick trace identification.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

PROBE/SCOPE COMPATIBILITY

Probe	Scope/Product
P6105A	434, 455, 464, 464M, 465, 466, 468, 475, 485, 7A16, SC504
P6106A	475, 485, DC 503A, DC 5009, DC 5010
P6122	2201, 2205, 2212, 2214, 2225

Passive Voltage Probes

P6105A • P6106A • P6122

PROBE SPECIFICATIONS CHART

Type	Cable Length meters (m)	Attenuation	Bandwidth Megahertz (MHz)	Comp. Range Picofarads (pF)	System Input Resistance Megaohms (MΩ)	Typical Input C Picofarads (pF)	Ground Reference	Readout
P6105A	2	10X	100	15 to 35	10	11	√	√
Opt. 01	1		100			9		
Opt. 03	3		90			13		
P6106A	2	10X	250	15 to 35	10	11	√	√
Opt. 01	1		250			9		
Opt. 03	3		150			13		
P6122	1.5	10X	100	15 to 35	10	11		

Note: Maximum voltage DC + peak AC ≤500.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6105A
1X, 100 MHz Modular Probe.
Includes: Retractable Hook Tip; Probe Tip Ground Cover; 5 in. Ground Lead, 12 in. Ground Lead; Alligator Clip; 4 Pairs of Colored Cable Markers; Adjustment Tool; Instruction Sheet (070-5516-01).

P6106A
10X, 250 MHz Modular Probe.
Includes: Same as P6105A except 3 in. Ground Lead instead of 12 in. Ground Lead; Instruction Sheet (070-5517-01).

P6122
10X, 100 MHz Modular Probe.
Includes: Same as P6105A; Instruction Sheet (070-5512-00).

OPTIONAL CABLE LENGTHS
(P6105A, P6106A)
Opt. 01 – 1 Meter Cable.
Opt. 03 – 3 Meter Cable.

RECOMMENDED ACCESSORIES
Also see pages 486 to 487.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Passive Voltage Probes

P6131 • P6133 • P6134C • P6136 • P6137 • P6138A • P6139A

Features

TDS SERIES, 2400 SERIES AND 11000 SERIES OSCILLOSCOPES

P6131
- 10X, 300 MHz
- 2.5 mm Subminiature Probe Tip

P6133
- 10X, 150 MHz
- 2.5 mm Subminiature Probe Tip
- 3.5 mm Compact Probe Tip Optional

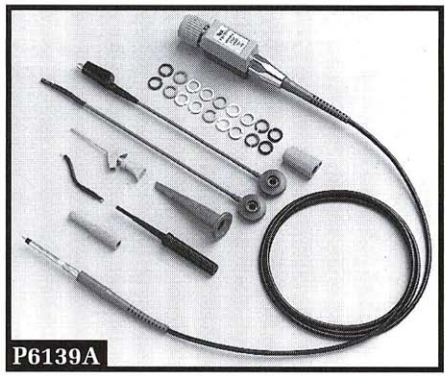
P6134C
- 10X, 400 MHz
- 3.5 mm Compact Probe Tip

P6136
- 10X, 350 MHz
- 2.5 mm Subminiature Probe Tip
- 3.5 mm Compact Probe Tip Optional

P6137
- 10X, 400 MHz
- 3.5 mm Compact Probe Tip

P6138A
- 10X, 400 MHz
- 3.5 mm Compact Probe Tip

P6139A
- 10X, 500 MHz
- 3.5 mm Compact Probe Tip



Modular Subminiature Probes

- Small geometry tips – Easier circuit access
- Readout for 10X attenuation factor – Reduces confusion and errors in measurement readings
- Flexible lightweight cable – Easier to use and reduces mechanical stress to device under test
- HYBRID/SMT Circuitry – Provides improved performance and reliability
- Modularity – Provides lower cost of ownership
- Compact size accessories – Provides compatibility with existing adapters
- UL safety certification

The P613X family of oscilloscope probes sets the standard for high performance passive voltage probes. Continued growth of the family paces Tektronix' new series of high performance bench top oscilloscopes, the TDS 700 Series, and high performance portable oscilloscopes, and the TDS 400 Series.

Both probes feature modular construction, HYBRID/SMT circuitry, a smaller probe head/cable assembly than traditional passive probes, 10X attenuation readout encoding, and a full complement of attachment accessories. Smaller probe tips and lightweight cable assemblies allow easy negotiation of dense circuitry or tight spaces.

The compact probe head/tip assembly is compatible with the full line of compact accessories. When the Subminiature/Compact-to-Miniature probe tip adapter (013-0202-02) is installed over the probe head/tip, the P6138A and P6139A probes are fully compatible with all miniature tip accessories.

The P6139A probe has been specifically designed for the TDS 500/600/700 Series of oscilloscopes to provide 500 MHz bandwidth at the probe tip, while presenting an 8 pF/10 MΩ input impedance to the circuit under test. Similarly, the P6138A's design meets the TDS 400 Series signal path requirements, helping to ensure the highest accuracy ever in a general purpose oscilloscope.

PROBE/SCOPE COMPATIBILITY

Probe	Scope/Product
P6131	2400 Series (2445, 2465)
P6133	2400 Series (2430/A/M, 2445A, 2445B)
P6134C	11000 Series (11A32, 11A34)
P6136	2400 Series (2431L, 2439, 2455 A/B, 2465A, 2467)
P6137	2400 Series (2432/A/M, 2440/M, 2445B, 2465B, 2467B/HD)
P6138A	TDS 400 Series
P6139A	TDS 500, 600, and 700 Series

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Passive Voltage Probes

P6131 • P6133 • P6134C • P6136 • P6137 • P6138A • P6139A

CHARACTERISTICS

Type	Cable Length meters (m)	Bandwidth Megahertz (MHz)	Attenuation	Comp. Range Picofarads (pF)	Input C Picofarads (pF)	System Input Resistance Megaohms (MΩ)	Readout	ID/ Ground Ref.
P6131	1.3	300	10X	14 to 18	10.8	10	√	
Opt. 02	2	250			13.5			
Opt. 03	3	150			14.5			
P6133	2	150	10X	10 to 25	12.7	10	√	
Opt. 01	1.3	150			11.4			
Opt. 03	3	120			14.5			
Opt. 25	1.3	150			10.8			
P6134C	1.5	400	10X	12 to 18	11.3	10	√	√
P6136	1.3	350	10X	12 to 18	10.8	10		
Opt. 25	1.3	350			10.8			
P6137	1.5	400	10X	12 to 18	10.8	10	√	√
P6138A	1.3	400	10X	12 to 18	10.0	10	√	√
P6139A	1.3	500	10X	8 to 12	8.0	10	√	√

Note: Maximum voltage DC + peak AC ≤ 500; Option 25 substitutes Compact for Subminiature tip.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6131
10X, 300 MHz Modular Subminiature Probe.
Includes: Retractable Hook Tip; Adjustment Tool; 8 in. Alligator Ground Lead; 6 in. Microhook Ground Lead; 2 in. Ground Lead; Probe Holder; 4 Pairs of Colored Cable Markers.

Opt. 02 – 2 Meter Cable.

Opt. 03 – 3 Meter Cable.

P6133
10X, 150 MHz Modular Subminiature Probe.
Includes: Same as P6131 except Instruction Sheet (070-5795-01).

Opt. 01 – 1.3 Meter Cable.

Opt. 03 – 3 Meter Cable.

Opt. 25 – 1.3 Meter Cable and Compact Tip. Includes: Same as P6137 except Instruction Sheet (070-5795-01).

P6134C
10X, 400 MHz Modular Compact Probe.
Includes: Adjustment Tool; Retractable Hook Tip; 2 in. Ground Lead; 6 in. Ground Lead; Miniature Alligator Clip; SMT KlipChip™, 4 Pairs of Colored Cable Markers; Instruction Sheet (070-7676-00).

P6136
10X, 350 MHz Modular Subminiature Probe.
Includes: Same as P6131 except Instruction Sheet (070-6025-01).

Opt. 25 – 1.3 Meter Cable and Compact Tip.
Includes: Same as P6137 except Instruction Sheet (070-6025-01).

P6137
10X, 400 MHz Modular Compact Probe.
Includes: Adjustment Tool; Retractable Hook Tip; 2 in. Ground Lead; 6 in. Ground Lead with 0.025 in. Square-pin Receptacle; 6 in. Ground Lead with Alligator Clip; SMT KlipChip™, Low Inductance Lead Ground Collar; 4 Pairs of Colored Cable Markers; Instruction Sheet (070-6432-00).

P6138A
10X, 400 MHz Modular Compact Probe.
Includes: Adjustment Tool; Retractable Hook Tip; 2 in. Ground Lead; 6 in. Ground Lead with 0.025 in. Square-pin Receptacle; 6 in. Ground Lead with Alligator Clip; SMT KlipChip™, Low Inductance Lead Ground Collar; 2 in. Low Inductance Ground Lead; 4 Pairs of Colored Cable Markers; Accessory Pouch; Instruction Sheet (063-0835-00).

P6139A
10X, 500 MHz Modular Compact Probe.
Includes: Same as P6138A except Instruction Sheet (063-0870-00).

OPTIONAL ACCESSORIES
Conversion Kit – Subminiature Tip to Compact Tip.
P6131. Order 040-1251-02.
P6133. Opt. 01. Order 040-1250-02.
P6136. Order 040-1253-02.

RECOMMENDED ACCESSORIES
See pages 482 to 487.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Small Geometry Probes

P6561A • P6562A • P6563A • P6243 • P6245

Features

FOR SURFACE MOUNT DEVICES

SMD PACKAGE SUPPORT
- 50 mil SO/SOIC
- 50 mil QUAD
- 25 mil JEDEC
- 0.5 mm EIAJ
- 0.65 mm EIAJ

CIRCUIT COMPATIBILITY
- CMOS
- BiCMOS
- FastCMOS
- TTL
- ECL

SCOPE COMPATIBILITY
- TDS Series
- TAS Series
- 2400 Series
- 11000 Series

P6561A
- 10X – 200 MHz
- <11 pF Loading
- Readout

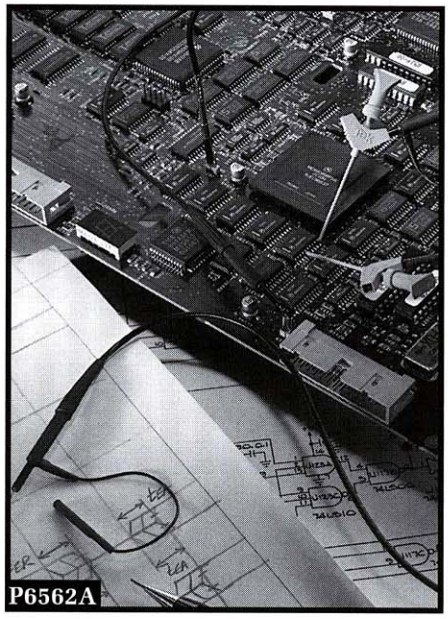
P6562A
- 10X – 350 MHz
- <11 pF Loading
- Readout

P6563A
- 20X – 500 MHz
- <5 pF Loading
- Readout

P6243/P6245
- 10X – 1 GHz (P6243 only)
- 10X – 1.5 GHz (P6245 Only)
- ≤1 pF Loading
- DC Offset (P6245 Only)
- For 11000 and TDS Series
- See 454 for complete information

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com


P6562A

SMD Standard Accessories

The P6561A, P6562A, and P6563A are scaled for surface mounted IC packages.

Their low-mass probe body is only 1.5 inches long and 100 mils wide.

Designed to match the oscilloscope's performance, these probes provide solutions for the most popular EIAJ and JEDEC surface mount packages.

SURFACE MOUNT DEVICE PROBING

While instrumentation improvements have provided a steady stream of digital troubleshooting tools, the physical challenges associated with probing small geometry ICs have gone unaddressed until now. SMD probes from Tektronix provide circuit designers the first complete, off-the-shelf solution for probing small geometry IC packages.

UNIQUE UTILITY

The basic contact of the SMD probe family is a 25 mil socket that accepts square or round pins. A variety of tip adapters permits convenient, non-destructive, temporary connection to the most popular EIAJ and JEDEC surface mount packages.

EXCEPTIONAL PERFORMANCE

Each SMD probe is designed to minimize capacitive loading on TTL, ECL, CMOS, FastCMOS, and BiCMOS circuits. The probe and oscilloscope form a measurement system optimized for circuit designers by providing fast transient response, high system bandwidth, and low capacitive circuit loading.

Figure 1 presents a sample conversion of the SMD probe family's capacitive circuit loading to an equivalent number of typical CMOS gates. Being aware of the potential effects of probe loading on the circuit under test can eliminate chasing false indicators, reduce test times, and lead to more accurate and repeatable measurements.

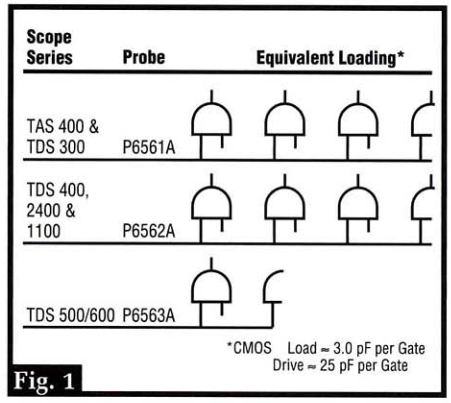
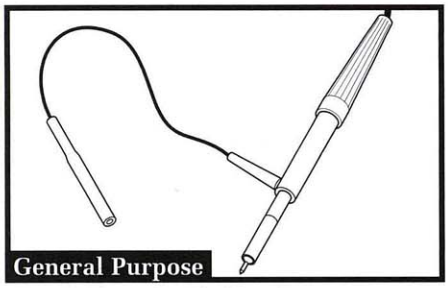


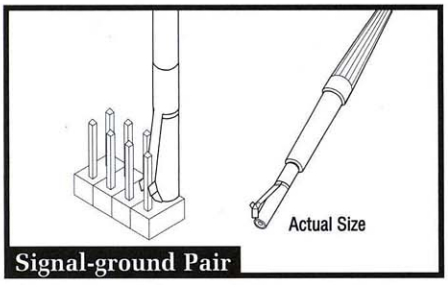
Fig. 1

Small Geometry Probes

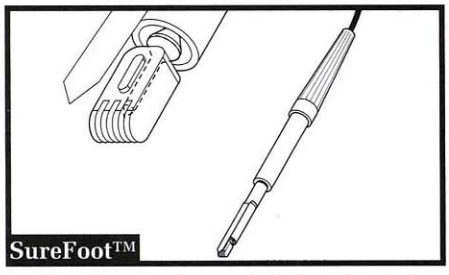
P6561A • P6562A • P6563A • P6243 • P6245



General purpose handheld probing.



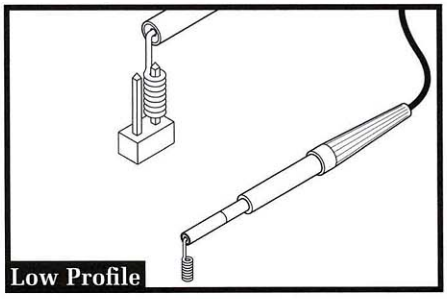
Signal-ground Pair – 25 mil Square-pin headers on 100 mil centers.



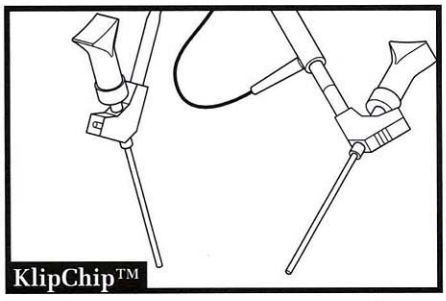
PQFP and Quad Packages – JEDEC 25 mil center lead spacing. EIAJ 0.5 and 0.65 mm center lead spacing.

SMD PROBE CHARACTERISTICS

Probe Set	P6561A	P6562A	P6563A
Digitizing Oscilloscopes	TDS 300	TDS 400, 2400, 11000	TDS 500/600/700 Series
Analog Oscilloscopes	TAS 400	2400	
Scope Plug-ins		11A32, 11A34/V	
Bandwidth (–3 dB)	200 MHz	350 MHz	500 MHz
Rise Time (typical)	<1.85 ns	<1.1 ns	<800 ps
Uniform Signal Delay	±150 ps	±125 ps	±100 ps
Attenuation	10X	10X	20X
Device Loading Capacitance (typical)	<11 pF	<11 pF	<5 pF
Device Loading Resistance	10 MΩ	10 MΩ	9.5 MΩ
Maximum Non-destructive Input Voltage	42 V (DC + peak AC)	42 V (DC + peak AC)	42 V (DC + peak AC)
Compensation Range	15 pF – 35 pF	12 pF – 35 pF	7 pF – 30 pF
Length	1.3 m	1.3 m	1.3 m



Circuit Boards in System Enclosures – 25 mil Square-pin headers on 100 mil centers.



SOIC/SOP Small Outline Packages – 50 mil center lead spacing.

PROBING TIP

For improved signal fidelity and probing convenience, a short ground blade is included. To use it, form a ground plane of copper clad on top of the IC to be probed. Attach short jumper wires from the device ground to the copper clad. Then, with the SureFoot™ probe tip installed, probe the device and display a cleaner signal on the scope.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6561A
200 MHz, 10X SMD Probe.
Includes: 2 ea. of 3 Pitches SureFoot® Tip Guides, 4 in. Ground Leads, Signal-ground Adapters, Blade-ground Adapters, and 1 ea. Adjustment Tool and Instruction Sheet.

P6562A
350 MHz, 10X SMD Probe.
Includes: 2 ea. of 3 Pitches SureFoot Tip Guides, 4 in. Ground Leads, Signal-ground Adapters, Blade-ground Adapters, and 1 ea. Adjustment Tool and Instruction Sheet.

P6563A
500 MHz, 20X SMD Probe.
Includes: 2 ea. of 3 Pitches SureFoot Tip Guides, 4 in. Ground Leads, Signal-ground Adapters, Blade-ground Adapters, and 1 ea. Adjustment Tool and Instruction Sheet.

P6243
Active FET Probe (See page 454).

P6245
Active FET Probe (See page 454).

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

RECOMMENDED ACCESSORIES
See page 480.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Surface Mount Device Interconnects

New SMK4 • SMG50 • SMCK1 • SMQK1 • SureFoot®

Features

NEW MICRO KlipChip™ ADAPTER
SMK4

- Hand Probe Fine Pitch SMD Packages
  - 25 mil JEDEC
  - 0.65 mm EIAJ
  - 0.5 mm EIAJ
- Thin Clip Body Width Allows Many PQFP Clips to be Mounted Side by Side and Simultaneously Tested

SureFoot ADAPTERS
SF200 and SF500 Series

- Hand Probe Fine Pitch SMD Packages
  - 25 mil JEDEC
  - 0.65 mm EIAJ
  - 0.5 mm EIAJ
- SF500 Series for P6562A, P6562A, P6563A, P6240, P6243 and P6245
- SF200 Series for P613X Family (3.5 mm) (P6133 Opt. 25, P6134C, P6136 Opt. 25, P6137, P6135A, P6138A, P6139A)

SMT KlipChip ADAPTER
SMG50

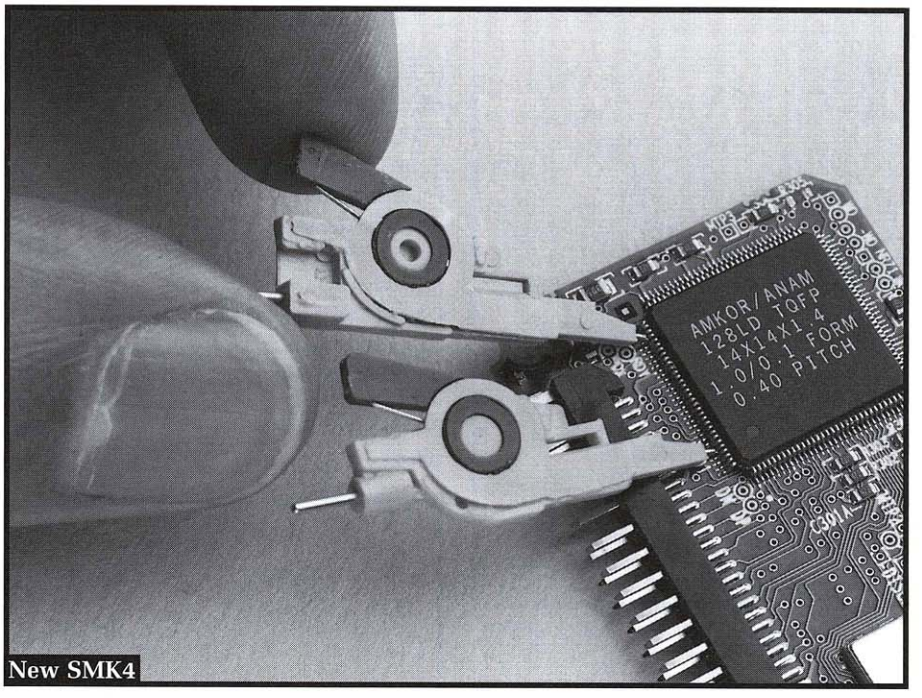
- Access to 0.050 in. Centers PLCC, SOIC, and Other Packages

PLCC/SOIC ADAPTER KITS
SMCK1 and SMQK1

- Assortment of SOIC or PLCC Clips
- Leads and SMT KlipChip™ Included
- Signal Insertion and Temporary Lead Jumpers Without Soldering

Applications

- Research and Design
- Manufacturing Test of SMD Circuitry
- Servicing of SMD Circuitry
- Prototype Debug and Design



New SMK4

Surface Mount Device Probing and Interconnects

The increasing use of surface mount technology (SMT) brings many benefits to electronic circuit board (ECB) design and manufacture. Among these are increased circuit density, increased product reliability, and lower assembly costs.

Troubleshooting and device interconnection, however, have become more difficult due to decreased device size, tighter lead spacing and increased ECB densities. Tektronix' offering of the following SMT probing and inter-connect devices meets these demanding requirements.

SMK4 Micro KlipChip Adapter

The SMK4 is an interface device which can attach to fine-pitch IC leads similar to the SMG50. The difference between the SMK4 and the SMG50 is the size. The SMK4 can be used to attach to PQFP packages up to a pitch of 0.5 mm which is five times smaller than the SMG50.

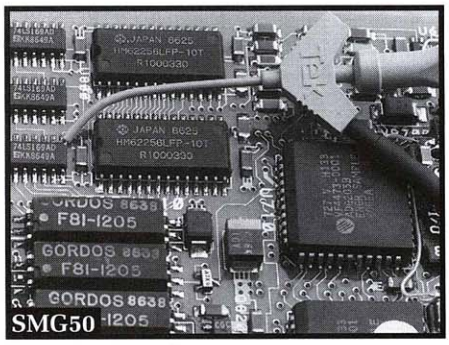
The kit of four 0.5 mm SMK4 Micro KlipChip Adapters are for use as probe tip accessory replacements with the P6247/P6246 and as a recommended accessory for the probes listed below, which can attach to the SMK4 0.025 in. lead.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Surface Mount Device Interconnects

New SMK4 • SMG50 • SMCK1 • SMQK1 • SureFoot®



SMT KlipChip Adapter.

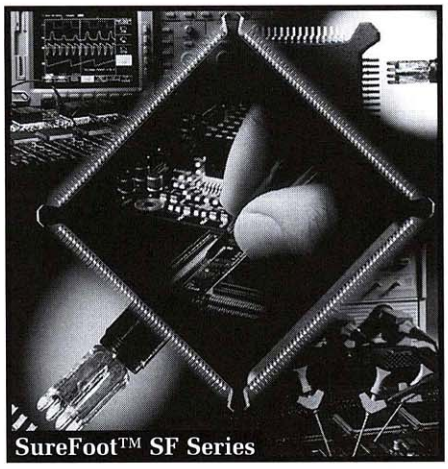
SMT KlipChip™ Adapter

The SMT KlipChip is an interface device for attachment of logic and analog probes to today's SMDs, DIPs, and discrete components. The SMT KlipChip is capable of attaching to components with maximum lead diameters of 0.095 inches and stackable on lead centers of 0.050 inches. Dual sided 0.025 inch lead contacts allow this grabber to be used in multiple signal insertion/acquisition.

Available as package of 20 (SMG50), or singularly (206-0364-00).

PLCC Quad Clips

For easy connection to Plastic Leaded Chip Carriers (PLCC) with "J" leads on 0.050 inch centers. Gold-plated contacts maintain low contact resistance. 0.025 inch square pins provide contact for probes, flying leads, etc.



SureFoot

PROBING 25 Mil JEDEC, 0.65 AND 0.5 mm EIAJ PACKAGES

SureFoot is an integral probe tip and miniature guide that enables fault-free "hands-on" probing of fine-pitch SMD packages. Guided by the IC's leads, SureFoot's miniature plastic tines align the probe before electrical contact is made. The tines also form a shield between IC leads, preventing the probe tip from shortening adjacent pins.

SureFoot conforms to EIAJ (Electronic Industry Association of Japan) or JEDEC (Joint Electron Device Engineering Council) packaging standards, assuring quick and reliable probe contact with fine-pitch IC leads.

Several color coded versions of SureFoot are available, addressing the most common SMD packages with leads spaced on 0.65 mm (EIAJ) and 25 mil (JEDEC) centers. A crystal orange version fits the tighter 0.5 mm lead spacing of several EIAJ packages.

SOIC Clips

Simplify connection to Small Outline Integrated Circuits (SOIC). The spring design provides a strong and accurate fit. Compatible with gullwing or "J" leads on 0.050 inch centers. Gold-plated contacts for low contact resistances; 0.025 inch upper square pins provide access for probe or flying lead connection.

Surface Mount Device Interconnects

New SMK4 • SMG50 • SMCK1 • SMQK1 • SureFoot™

SureFoot SELECTION GUIDE

Package Lead Spacing	Package Standard	Color Code	SureFoot Compatibility P613X (3.5mm)	Active SMD Probes P6243/P6245	SMD Probes P6561A/2A/3A
50 mil	JEDEC	Yellow	SF201	SF501	SF501
25 mil	JEDEC	Blue	SF202	SF502	SF502
0.65 mm	EIAJ	Blue	SF202	SF502	SF502
0.5 mm	EIAJ	Red	SF203	SF503	SF503

SMK4 SELECTION GUIDE

SMK4 Direct Connection	Used with Probe
Direct Connection to Probe Head	P6561A, P6562A, P6563A, P6243, P6245
196-3268-01 Ground Lead with 0.025 in. receptacle	P6561A, P6562A, P6563A
196-3302-00 6 in. Receptacle Ground Lead	P6131, P6133, P6133 Opt. 25, P6136, P6136 Opt. 25, P6138, P6139A
196-3305-00 6 in. Receptacle Ground Lead	P6131, P6133, P6133 Opt. 25, P6134, P6134C, P6135A, P6136, P6136 Opt. 25, P6137, P6138, P6139A, P6156
196-3382-00 3 in. Receptacle Ground Lead	P6131, P6133, P6133 Opt. 25, P6134, P6134C, P6135A, P6136, P6136 Opt. 25, P6137, P6138 P6139A, P6156
103-0177-01 Flexible Tip	P61XXB, P6202A, P6204, P6205
206-0193-00 Flex Tip for 0.025 in. Square Pin	P61XXB, P6202A, P6204, P6205
015-0325-00 Dual Lead Adapter	P61XXB, P6202A, P6204, P6205
020-2008-00 Y-lead Adapter	P6240
196-3410-00 Y-lead Adapter	P6246, P6247
020-2203-00 Y-lead Adapter	P6246, P6247

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SMK4
Micro KlipChip Adapter
Includes: 4 each Adapters.

SMG50
SMT KlipChip Adapter
Includes: 20 SMT KlipChip.

SMCK1
SOIC Engineering Kit.
Includes: 1 each of 8, 14, 16, 20, 24-Pin SOIC Clips plus 4 SMT KlipChip™ Adapter; 8 Electrical Leads with (0.025 in.) Square-pin Connectors.

SMQK1
PLCC Engineering Kit.
Includes: 1 each of 20, 28, 44, 52, 68, 84-Pin PLCC Clips plus 4 SMT KlipChip Adapter; 8 Electrical Leads with (0.025 in.) Square-pin Connectors.

SF201 (50 mil pitch)
SureFoot for P613X (3.5 mm) Passive Probes.
Includes: 12 Yellow 50 mil/0.65 mm SureFoot Tip Guides.

SF202 (25 mil pitch/0.65 mm pitch)
SureFoot for P613X (3.5 mm) Passive Probes.
Includes: 12 Blue 25 mil/0.65 mm SureFoot Tip Guides.

SF203 (0.5 mm pitch)
SureFoot for P613X (3.5 mm) Passive Probes.
Includes: 12 Red 0.5 mm SureFoot Tip Guides.

SF501 (50 mil)
SureFoot for P6561A, P6562A, P6563A, P6245 SMD Probes.
Includes: 12 Yellow 50 mil (25 mil-pin) SureFoot Tip Guides.

SF502 (25 mil/0.65 mm Pitch)
SureFoot for P6561A, P6562A, P6563A, P6245 SMD Probes.
Includes: 12 Blue 25 mil/0.65 mm (25 mil-pin) SureFoot™ Tip Guides.

SF503 (0.5 mm Pitch)
SureFoot for P6561A, P6562A, P6563A, P6245 SMD Probes.
Includes: 12 Red 0.5 mm (25 mil-pin) SureFoot Tip Guides.

Electrical Leads – for SMQK1 and SMCK1
Package of 10 each with 0.025 in. Square-pin Receptacles.
4 in. length. Order 198-5817-00.
6 in. length. Order 198-5818.00.
8 in. length. Order 198-5819-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Articulated Arm
PPM203B

Features

MECHANICALLY ASSISTED PROBING

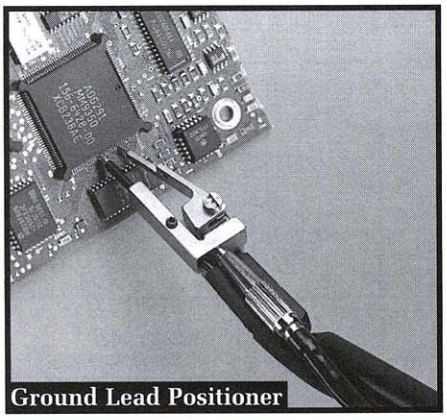
PPM203B

- 3 Axis Articulated Arm with Hi-mass Base
- 119-4841-00 Ground/Lead Positioner
- 119-4842-00 Ground/Lead Positioner

Applications

- Research and Design
- Prototype Design

PPM203B/P6245


Ground Lead Positioner

Probing Fine Pitch Devices

Probing today's designs with their delicate fine pitch devices is safer and more convenient with the Tektronix PPM articulating arm. The PPM allows designers to guide standard handheld probes onto the small geometries of fine-pitch interconnects, SMD packages, MCMs (multi-chip-modules), hybrids, and ICs.

The PPM articulating arm provides high accuracy and resolution by mechanically assisted probe positioning, helping designers meet the physical demands of probing the constantly shrinking geometry of devices.

PPM203B

The PPM203B has a three axis arm system. It is a general purpose benchtop probing aid designed to be used when probing PC Boards, Hybrids, and MCMs that employ fine pitch devices and interconnects.

The PPM203B incorporates a weighted base that makes it well suited to probing fine pitches in benchtop applications.

GROUND LEAD POSITIONERS

Ground Lead Positioners allow independent positioning of signal and ground leads while maintaining a short ground for enhanced performance. Their spring loaded ground tips make it easier to maintain contact with the probed device.

The 119-4841-00 accepts the Tektronix SMD (P656X) Series probes. The 119-4842-00 may be used with Tektronix 2.5 mm subminiature, 3.5 mm compact, and 4mm active probes.

Characteristics

PPM203B

Number of Manipulator Axes – PPM203B, 3 Axis (X,Y and Z)

Manipulator Travel – PPMS203B, 1 in. min.

Manipulator Lead Screw Pitch – PPM203B, 10 threads per inch.

Probe Mounting – Accepts most Tektronix probes including SMD, 2.5 mm, 3.5 mm, 4 mm, 5 mm and P6245 probe styles.

Attachment Method to Work Surface – PPM203B, manually positioned with weighted base.

Articulated Arm Reach – X,Y: 14 in., Theta: 180°.

Ground Lead Positioners – For Tektronix SMD probes and Tektronix 2.5 mm subminiature, 3.5 mm compact, and 4mm active probes. Reach: (signal lead to ground lead) 40°, >1 inch. Travel: (spring loaded ground pin) >0.1 inch.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

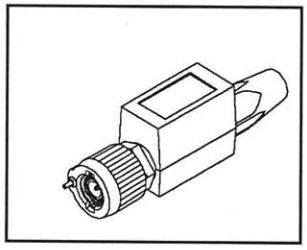
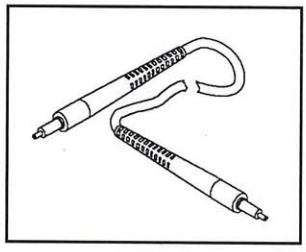
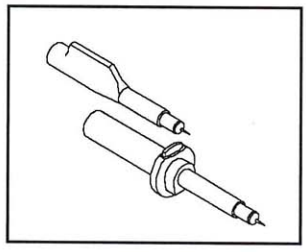
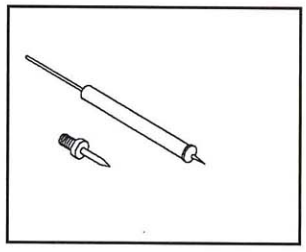
PPM203B
Articulated Arm, 3 Axis with Hi-mass Base.
Includes: Articulated Arm; Hi-mass Base; 6 probe adapters to attach various probe styles.

Ground Lead Positioners – Includes one year warranty.
For Tektronix SMD Probes. Order 119-4841-00.
For 2.5 mm Subminiature Active Probe. Order 119-4842-00.
For 3.5 mm Compact Active Probe. Order 119-4842-00.
For 4 mm Active Probe. Order 119-4842-00.

Probe Adapters – Additional probe adapters can be ordered by the following part numbers:
SMD Probes. Order 407-4365-00.
P6245. Order 407-4368-00.
4 mm, Active Probes. Order 407-4370-00.
2.5 mm, Subminiature Probes. Order 407-4366-00.
3.5 mm, Compact Probes. Order 407-4367-00.
5 mm, Miniature Probes. Order 407-4369-00.

Replacement Parts

PASSIVE AND ACTIVE PROBE GENERAL REPLACEMENT PARTS

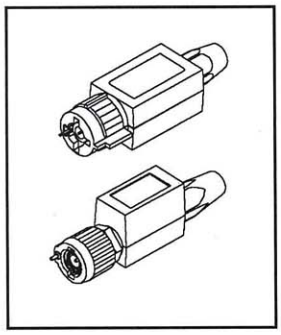





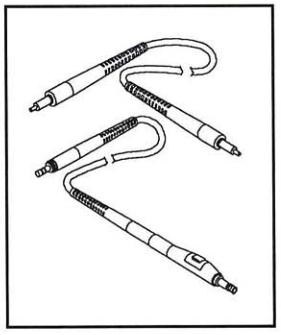
Probe	Length (m)	Connector/ Comp. Box	Probe Cable	Probe Head	Probe Tip/ Hybrid Tip
P6101B	2	N/A	N/A	N/A	131-4997-01*2
P6102A	2	206-0352-00	174-0976-00	206-0302-00	206-0338-01*2
P6103B	2	N/A	N/A	N/A	131-4997-01*2
P6105A	1	206-0331-00	174-0975-00	206-0328-00	206-0336-01*2
	2	206-0334-00	174-0976-00	206-0301-00	206-0337-01*2
	3	206-0320-02	174-0977-00	206-0302-00	206-0338-01*2
P6106A	1	206-0313-01	174-0975-00	206-0328-00	206-0336-01*2
	2	206-0319-01	174-0976-00	206-0301-00	206-0337-01*2
	3	206-0320-01	174-0977-00	206-0302-00	206-0338-01*2
P6107A	2	206-0247-02	174-0976-00	206-0217-02	206-0339-03*2
P6108A	1	206-0332-01	174-0975-00	206-0303-00	206-0336-01*2
	2	206-0318-02	174-0976-00	206-0304-00	206-0337-01*2
	3	206-0333-00	174-0977-00	206-0305-00	206-0338-01*2
P6109B	2	N/A	N/A	N/A	131-4997-01*2
P6111B	2	N/A	N/A	N/A	131-4997-01*2
P6112	2	N/A	N/A	N/A	131-4997-01*2
P6113B	2	N/A	N/A	N/A	131-4997-01*2
P6117	2	N/A	N/A	N/A	131-4997-01*2
P6119B	2	N/A	N/A	N/A	131-4997-01*2
P6121	1.5	206-0311-00	174-0967-00	206-0323-00	206-0341-01*2
P6122	1.5	206-0312-00	174-0967-00	206-0324-00	206-0342-01*2
	2	206-0318-00	174-0968-00	206-0325-00	206-0343-01*2
	3	206-0318-01	174-0969-00	206-0326-00	206-0344-01*2
P6129B	2	N/A	N/A	N/A	131-4997-01*2
P6148A	2	206-0255-02	174-0976-00	206-0217-02	206-0339-03*2
P6149A	2	206-0255-02	174-0976-00	206-0217-02	206-0339-03*2
P6201	1.8	N/A	N/A	N/A	206-0200-00*3
P6202A	2	N/A	N/A	N/A	206-0230-03*1
P6203*4	1.5	N/A	N/A	206-0391-00	131-4280-00*3
P6204*4	1.5	N/A	N/A	206-0390-00	131-4280-00*3
P6205*4	1.5	N/A	N/A	N/A	131-4280-00*3
P6206*4	1.7	N/A	N/A	N/A	131-4280-00*3
P6243*4	1.3	N/A	N/A	N/A	131-5638-10*1
P6245*4	1.3	N/A	N/A	N/A	131-5638-10*1
P6420	1	N/A	174-0975-00	206-0236-01	206-0230-03*1
	2	N/A	174-0976-00	206-0236-01	206-0230-03*1
	3	N/A	174-0977-00	206-0236-01	206-0230-03*1
P6561A	1.3	N/A	206-0417-10	206-0417-10	131-5638-10*1
P6562A	1.3	N/A	206-0417-10	206-0417-10	131-5638-10*1
P6563A	1.3	N/A	206-0459-00	206-0459-00	131-5638-10*1

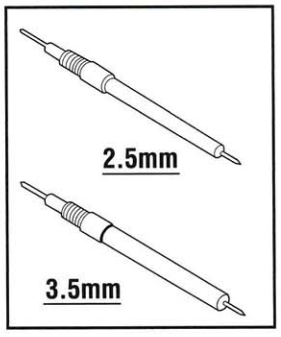
*1 *Probe tips in package of ten.*
*2 *Probe hybrid tip assemblies in packages two each.*
*3 *Probe hybrid tip assembly in quantities of one.*
*4 *131-1685-01 contact for readout + power (P6205, P6205, P6217, P6245, P6243, P6231).*

Replacement Parts

PASSIVE AND ACTIVE PROBE GENERAL REPLACEMENT PARTS







Probe	Length (m)	Connector/ Comp. Box	Probe Cable	Probe Tip/ Hybrid Tip	Probe Tip/ Hybrid Tip Color
P6053C	6	206-0421-00	174-2132-01	206-0422-01	tip – gray/tail – red
Opt. 01	3.5	N/A	174-2133-01	206-0392-00	tip – gray/tail – blue
Opt. 03	9	N/A	174-2134-01	206-0422-02	tip – blue/tail – red
P6130	1.5	206-0313-00	174-0970-00	206-0270-10*2	tip – brown/tail – blue
	2	206-0319-00	174-0971-00	206-0270-12*2	tip – brown/tail – yellow
	3	206-0320-00	174-0972-00	206-0270-11*2	tip – brown/tail – red
P6131	1.3	206-0314-00	174-0973-00	206-0265-10*2	tip – clear/tail – blue
	2	206-0321-00	174-0971-00	206-0265-12*2	tip – clear/tail – yellow
	3	206-0322-00	174-0972-00	206-0265-11*2	tip – clear/tail – red
P6133	2	206-0350-00	174-0971-00	206-0265-12*2	tip – clear/tail – yellow
Opt. 01	1.3	206-0349-00	174-0973-00	206-0265-13*2	tip – clear/tail – clear
Opt. 03	3	206-0351-00	174-0972-00	206-0265-11*2	tip – clear/tail – red
Opt. 25	1.3	206-0349-00	174-0973-00	206-0393-00*2	tip – clear/tail – natural
P6134C	1.5	206-0420-00	174-1081-04	206-0418-00*2	tip – black/tail – red
P6135A (13 to 17pF)*4	1.5	N/A	N/A	206-0416-00*3	tip – red/tail – natural
(18 to 22pF)*4		N/A	N/A	206-0419-00*3	tip – black/tail – yellow
(45 to 49pF)*4		N/A	N/A	206-0415-00*3	tip – blue/tail – natural
P6136	1.3	206-0359-00	174-0978-00	206-0265-10*2	tip – clear/tail – blue
Opt. 25	1.3	206-0359-00	174-0978-00	206-0392-00*2	tip – gray/tail – blue
P6137	1.5	206-0389-01	174-1081-04	206-0378-00*2	tip – black/tail – natural
P6138	1.3	206-0439-00	174-0978-00	206-0392-00*2	tip – gray/tail – blue
P6138A	1.3	N/A	174-3649-00	206-0392-00*2	tip – gray/tail – blue
P6139A	1.3	206-0440-00	174-0978-00	206-0441-00*2	tip – blue/tail – yellow
P6150*1 (10X)	1	N/A	174-1341-00	206-0399-03*2	N/A
(1X)		N/A		206-0398-00*2	N/A
P6156 (10X)	1.5	N/A	174-1127-00	206-0380-00*2	tip – blue/tail – black
Opt. 25 adds 100X tip		N/A	N/A	206-0382-00*2	tip – red/tail – black
20X tip		N/A	N/A	206-0381-00*2	tip – gray/tail – black
P6230	1.6	N/A	N/A	206-0279-10*2	tip – yellow/tail – blue
P6231*5	1.5	N/A	N/A	206-0279-10*2	tip – yellow/tail – blue

*1 *Not pictured above.*

*2 *Probe hybrid tip assembly in quantities of one.*

*3 *Consists of a matched pair.*

*4 *Scope Input Capacitance Range.*

*5 *131-1685-01 contact for readout + power (P6205, P6205, P6217, P6245, P6243, P6231).*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

SMD (P656XA) and P6240

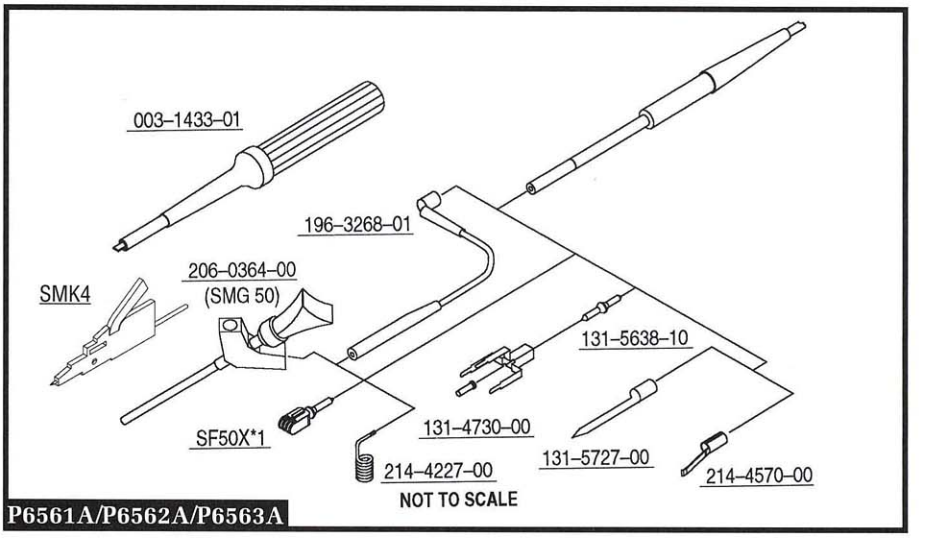
ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6561A/P6562A/P6563A

Part Number	Description
003-1433-00	Adjustment Tool.
003-1433-01	Adjustment Tool pkg. of 5.
131-5727-00	Low Inductance Ground Lead.
131-4730-00	SMT Probe Tip Circuit Board Test Points, pkg. of 5.
131-5638-11	Receptacle Tip for P656X/AS, pkg. of 10.
196-3268-01	Ground Lead with 0.025 in. Receptacle, pkg. of 5.
206-0364-00	SMT KlipChip™, 1 each.
214-4227-00	Right Angle Square-pin Adapter.
214-4570-00	100 mil Square-pin Ground Adapter.
SMK4	Micro KlipChip Adapter, 4 each.
SMG50	SMT KlipChip, 20 each.
SF501	SureFoot® Probe Tip Adapter, pkg. of 12, Yellow, 50 mil Pitch.
SF502	SureFoot Probe Tip Adapter, pkg. of 12, Blue, 25 mil/0.65 mm Pitch.
SF503	SureFoot Probe Tip Adapter, pkg. of 12, Red, 0.5 mm Pitch.

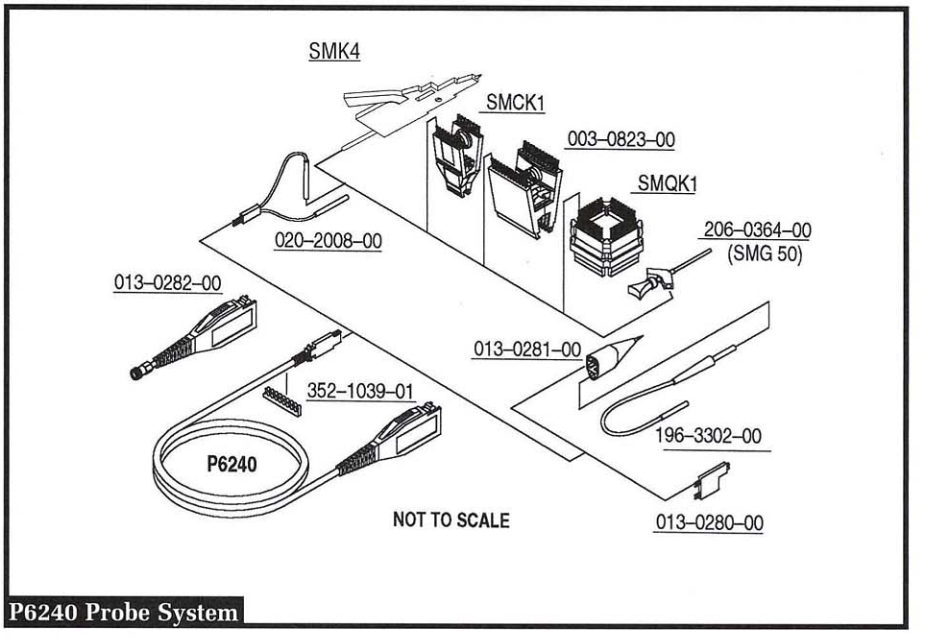
**1 See SF501/SF502/SF503 above or page 476 for complete selection information.*



P6561A/P6562A/P6563A

P6240 PROBE SYSTEM FOR TLS216

Part Number	Description
003-0823-00	24-Pin DIP, Clothespin Style.
013-0280-00	One to Two Adapter.
013-0281-00	Handheld Probe Tip Adapter w/ Tips.
013-0282-00	50 to 75 Ω Converter.
196-3302-00	6 in. Ground Lead.
020-2008-00	Y Lead Adapter, pkg. of 10.
206-0364-00	SMT KlipChip, 1 each.
352-1039-01	Probe Cable Loom, pkg. of 6.
SMK4	Micro KlipChip Adapter, 4 each.
SMG50	SMT KlipChip, 20 each.
SMCK1	SOIC Engineering Kit. (See page 474 for included items.)
SMQK1	PLCC Engineering Kit. (See page 474 for included items.)



P6240 Probe System

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

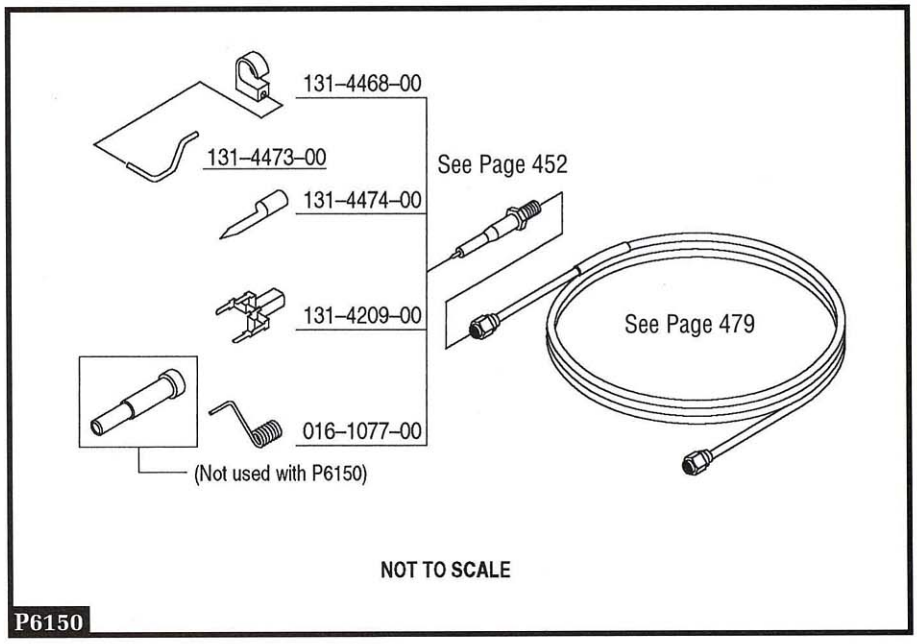
P6150(4mm) • P6207(4mm) • P6217(4mm) • SD-14(4mm)

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6150

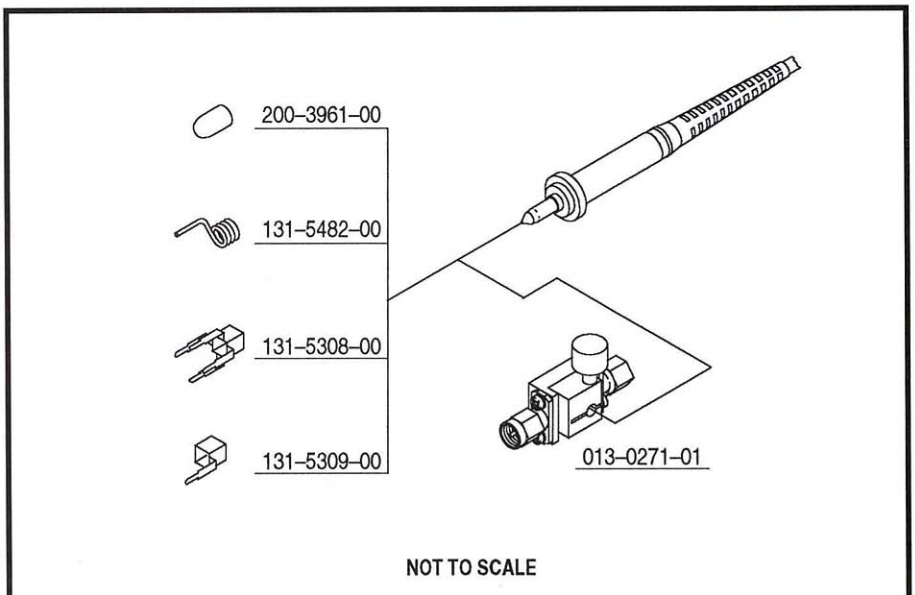
Part Number	Description
016-1077-00	Spring Ground Contact, 2 each of 5 Lengths.
131-4209-00	Probe Tip to CKT BD Adapter.
131-4468-00	Ground Collar.
131-4473-00	1/4 in. Ground Lead.
131-4474-00	1 Leg Ground Contact.



P6150

P6207, P6217, SD-14

Part Number	Description
013-0271-01	SMA Adapter to SD-14.
131-5308-00	4 Leg Ground Contact.
131-5309-00	1 Leg Ground Contact.
131-5482-00	Spring Ground Contact 2 each of 5 Lengths.
200-3961-00	ESD Protective Probe Tip Cover.



4mm Accessories for P6207, P6217, SD-14

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

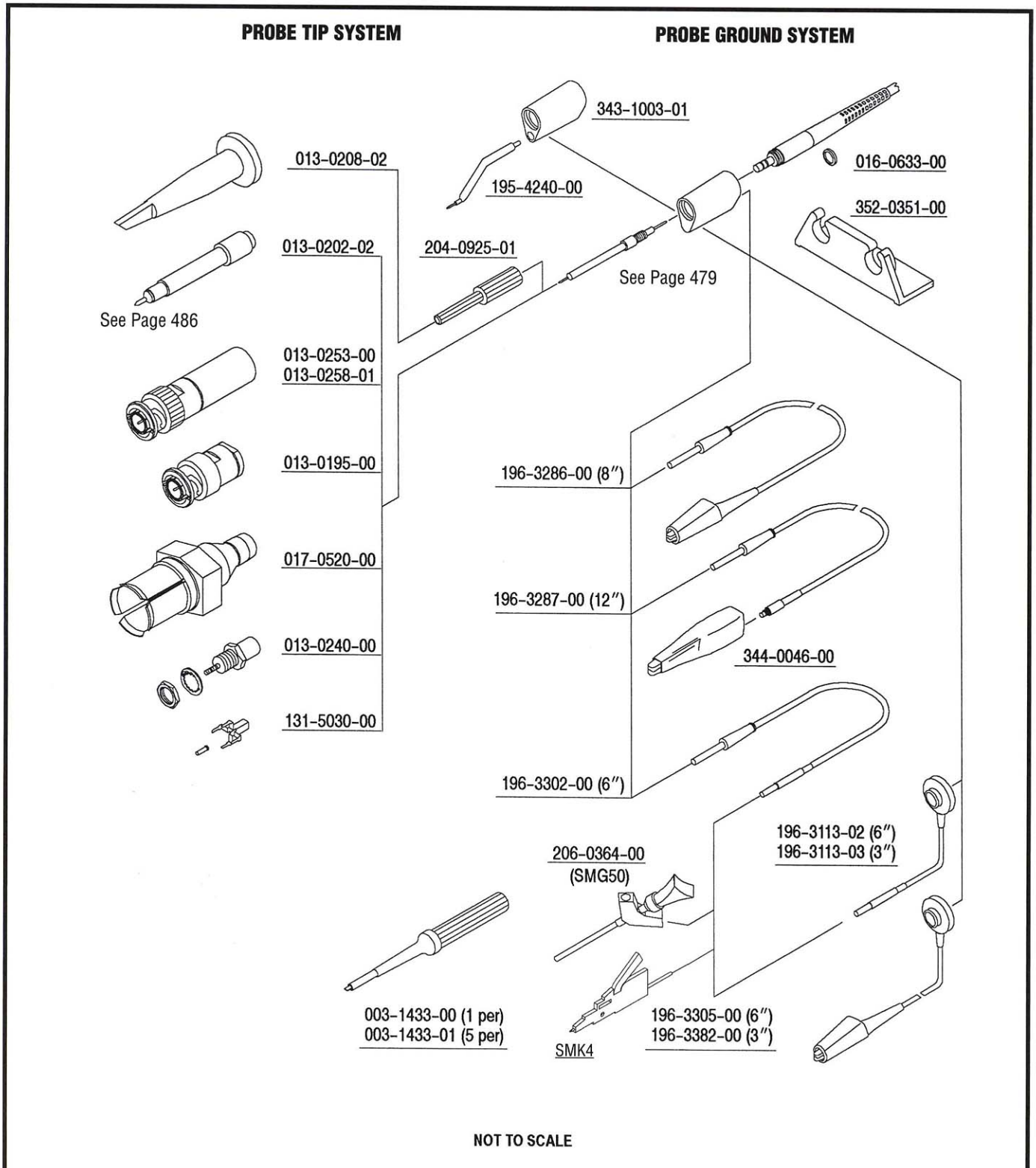
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

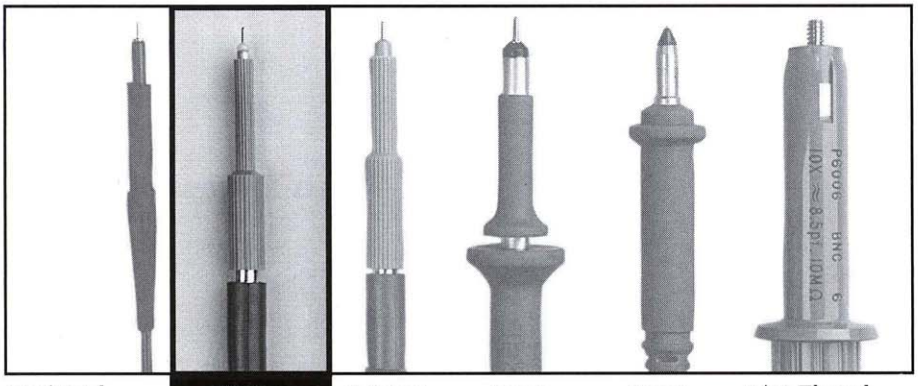
2.5mm (Subminiature) Probe System



2.5 mm (Subminiature) Probe Accessories for P6130, P6131, P6133, P6134, P6135, P6136, P6230, P6231

Probe Accessories

2.5mm (Subminiature) Probe System



Tip/Head Style: SMD | ***2.5 mm Subminiature*** | *3.5 mm Compact* | *5 mm Miniature* | *4 mm* | *6/32 Thread Monolithic*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Part Number	Description
003-1433-00	Adjustment Tool.
003-1433-01	Package of 5 each of 003-1433-00, above.
013-0195-00	Subminiature Probe Tip to BNC Adapter.
013-0202-02	Subminiature/Compact-to-Miniature Probe to Adapter (allows use of miniature probe tip accessories). See page 486.
013-0208-02	Retractable Hook Tip for Subminiature Tip Probes.
013-0240-00	Subminiature Probe Tip Chassis Mount Test Jack.
013-0253-00	Subminiature Probe Tip to BNC Adapter Thread Locking (non-terminated).
013-0258-01	P6562 Subminiature Probe Tip to BNC Adapter, Thread Locking, 50 Ω Terminated.

**1 Subminiature (2.5 mm) Probes can be used in place of the Signal/Ground pins.*

Part Number	Description
016-0633-00	Cable Marker Set for all Modular Cables (P610X/A/B, P612X, P613X/A, P62X, (except P6201, P6202A)).
017-0520-00	Subminiature Probe Tip to GR 50 Ω Termination Adapter.
131-5030-00	Subminiature Probe Tip Circuit Board Test Points (Pkg. 25).
195-4240-00	Low Impedance Ground Contact.
196-3113-02	6 in. Slip-on Ground Lead.
196-3113-03	3 in. Slip-on Ground Lead.
196-3286-00	8 in. Alligator Ground Lead.
196-3287-00	12 in. Slip-on Ground Lead.
196-3302-00	6 in. Alligator Ground Lead (not compatible with P6137, P6134C, P6053C or P6156).

Part Number	Description
196-3305-00	6 in. Alligator Ground Lead.
196-3382-00	3 in. Alligator Ground Lead.
204-0925-01	Subminiature Probe Tip Attenuator Tip Cover.
206-0364-00	SMT KlipChip™ Adapter.
343-1003-01	Ground Collar.
344-0046-00	#6-32 Thread Alligator Ground Clip.
352-0351-00	Probe Holder, Self-adhesive Back, Black.
352-0670-00	Tip Holder (not shown).

SMD ATTACHMENT TOOLS

SMG50	SMT KlipChip Adapter, package of 20.
SMK4	Micro KlipChip™ Adapter, (4 each).

See pages 472 to 477 for complete selection of SMD Tools.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

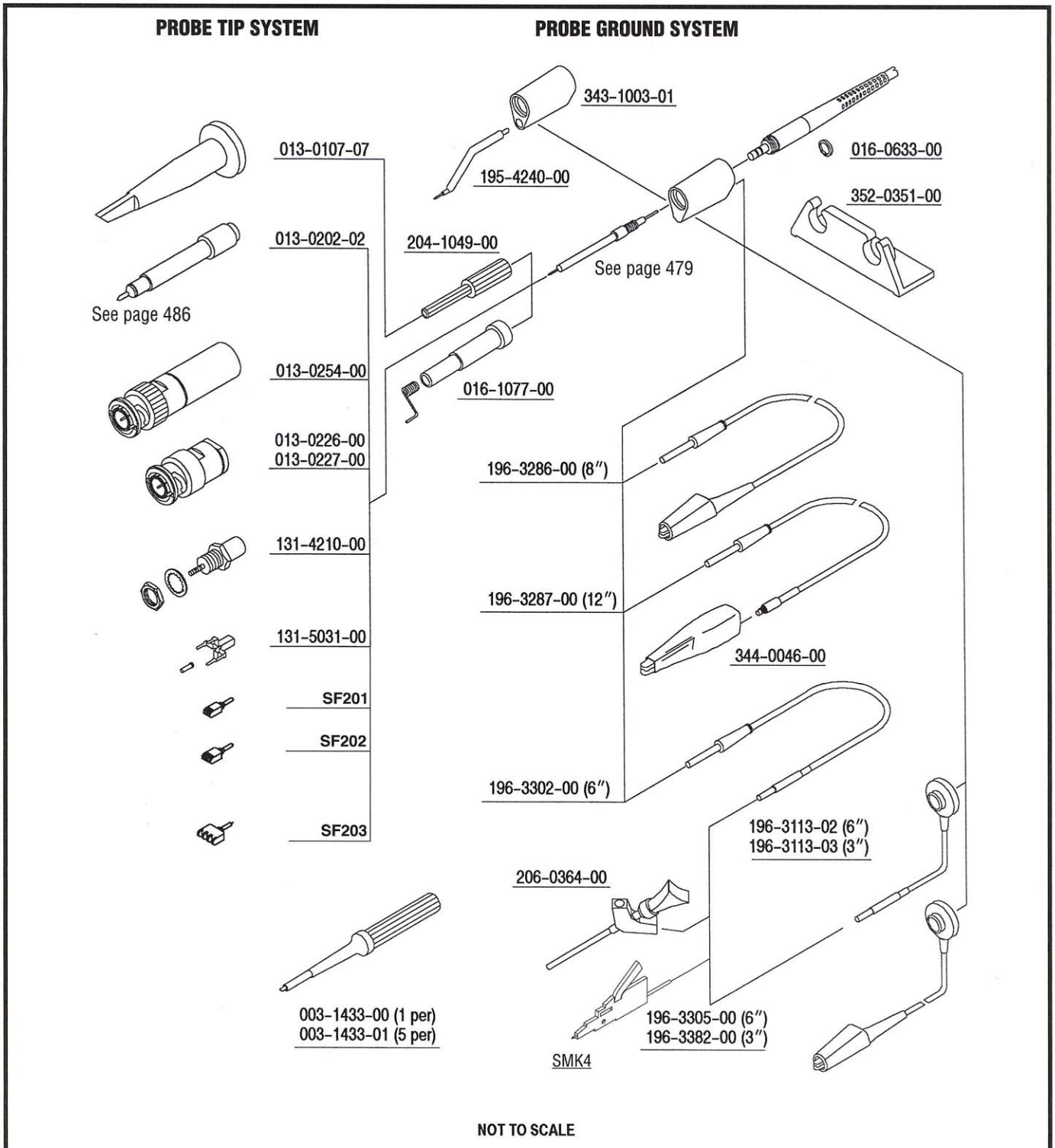
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

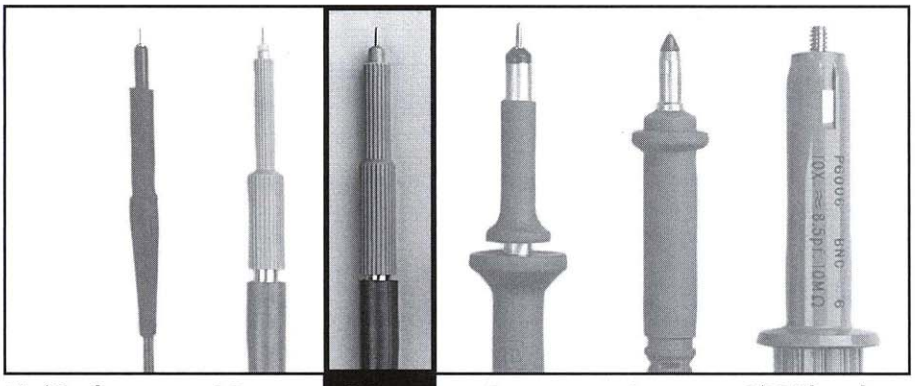
3.5mm (Compact) Probe System



3.5 mm (Compact) Probe Accessories for P6053C, P6133 Opt. 25, P6134C, P6135A, P6136 Opt. 25, P6137, P6138, P6138A, P6139A, P6156

Probe Accessories

3.5mm (Compact) Probe System



Tip/Head Style:	*SMD*	*2.5 mm Subminiature*	***3.5 mm Compact***	*5 mm Miniature*	*4 mm*	*6/32 Thread Monolithic*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Part Number	Description
003-1433-00	Adjustment Tool.
003-1433-01	Package of 5 each of 003-1433-00, above.
013-0107-07	Retractable Hook Tip for Compact Tip Probes.
013-0202-02	Subminiature/Compact-to-miniature Probe to Adapter (allows use of miniature probe tip accessories). See page 486.
013-0226-00	Compact Probe Tip to BNC Adapter (non-terminated).
013-0227-00	50 Ω Compact Probe Tip to BNC Termination Adapter.
013-0254-00	Compact Probe Tip to BNC Adapter Thread Locking (non-terminated).
016-0633-00	Cable Marker Set For All Modular Cables (P610X/A/B, P612X, P613X/A, P623X, P62XX)(except P6201, P6202A).
016-1077-00	Ground Tip Contact for Compact Tip Probes. 2 ea. Five Different Probe Tip to Ground Contact Spacings.
131-4210-00	Compact Probe Tip Chassis Mount Test Jack.
131-5031-00	Compact Probe Tip Circuit Board Test Points (pkg. of 25).
195-4240-00	Low Impedance Ground Contact.
196-3113-02	6 in. Slip-on Ground Lead.
196-3113-03	3 in. Slip-on Ground Lead.
196-3286-00	8 in. Alligator Ground Lead.
196-3287-00	12 in. Slip-on Ground Lead.
196-3302-00	6 in. Alligator Ground Lead (not compatible with P6137 P6134C, P6053C or P6156).
196-3305-00	6 in. Alligator Ground Lead.
196-3382-00	3 in. Alligator Ground Lead.
204-1049-00	Compact Probe Tip Attenuator Tip Cover.
206-0364-00	SMT KlipChip™ Adapter.
343-1003-01	Ground Collar.
344-0046-00	#6-32 Thread Alligator Ground Clip.
352-0351-00	Probe Holder, Self-adhesive Back, Black.

SMD ATTACHMENT TOOLS

SMG50	SMT KlipChip Adapter, pkg. of 20.
SMK4	Micro KlipChip™ Adapter 4 each.
SF201	SureFoot® Probe Tip Adapter, pkg. of 12, Yellow, 50 mil Pitch.
SF202	SureFoot Probe Tip Adapter, pkg. of 12, Blue, 25 mil/0.65 mm Pitch.
SF203	SureFoot® Probe Tip Adapter, pkg. of 12, Red, 0.5 mm Pitch.

See pages 472 to 477 for complete selection of SMD Tools.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

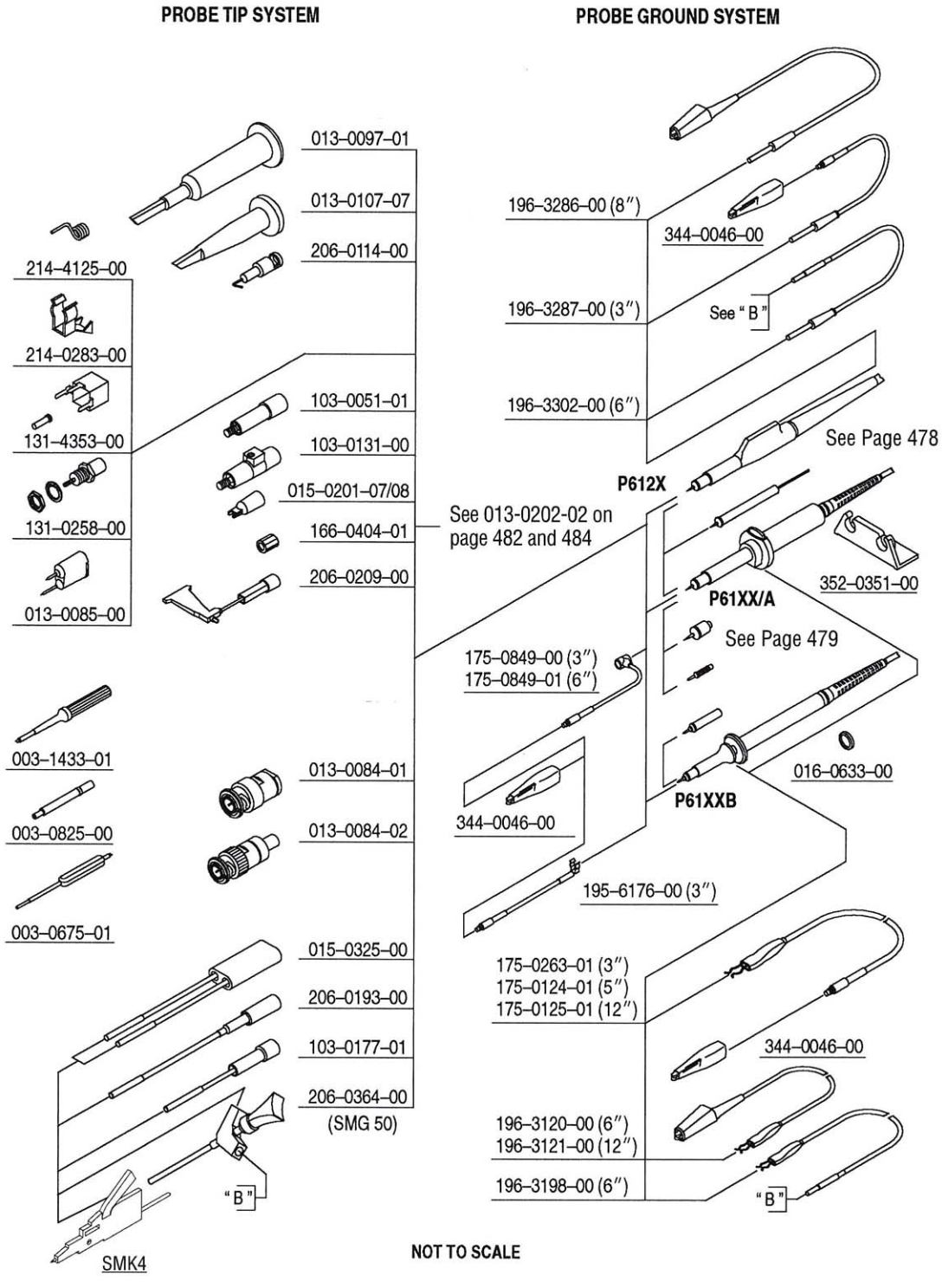
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

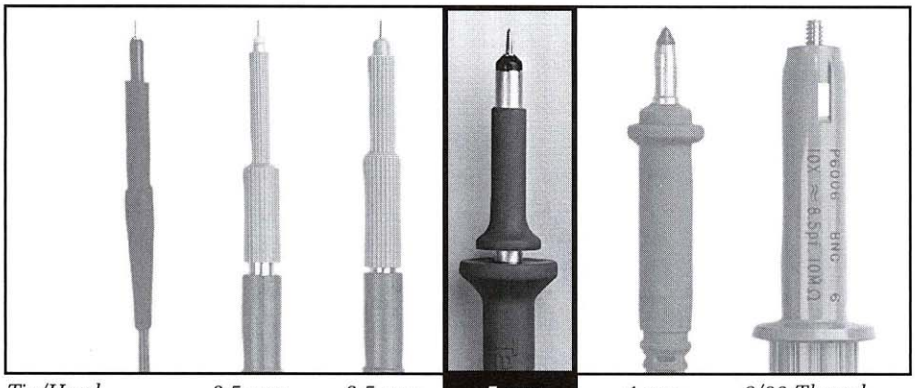
5mm (Miniature) Probe System



5 mm (Miniature) Probe Accessories for P6048, P6053, P6053B, P6055, P6056, P6057, P6062B, P6063B, P61XX/A Family, P612X Family, P61XXB Family, P6202A with Adapter, P6203, P6204, P6205, and P6206

Probe Accessories

5mm (Miniature) Probe System



Tip/Head Style:	*SMD*	*2.5 mm Subminiature*	*3.5 mm Compact*	***5 mm Miniature***	*4 mm*	*6/32 Thread Monolithic*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

MINIATURE PROBE ACCESSORIES

Part Number	Description
003-0675-01	Adjustment Tool P6202A.
003-0825-00	Tip Extractor for Miniature Probes (except for P610X/"A" Version and P612X Family Probes).
003-1433-00	Adjustment Tool.
003-1433-01	Package of 5 each of 003-1433-00, above.
013-0084-01	Miniature Probe Tip to BNC Adapter (non-terminated).
013-0084-02	Miniature Probe Tip to BNC Adapter for All except P6202A, P6420, and P6201 Adapter.
013-0085-00	Bayonet Ground Assembly.
013-0097-01	Retractable Hook Tip for P6202A and P6420.
013-0107-07	Retractable Hook Tip (for all except P6202A and P6420).
015-0201-07	IC Test Ground Cover, Gray (100 mil spacing), package of 10.
015-0201-08	IC Test Ground Cover, Gray (100 mil spacing), package of 100.
015-0325-00	Dual Lead Adapter.
016-0633-00	Cable Marker Set for all Modular Cables (P610X/A/B, P612X, P613X/A, P623X, P62XX except P6201, P6202A).
103-0051-01	Screw Tip (#6-32).
103-0131-00	Screw Tip with Ground Connection (#6-32).
103-0177-01	Flexible Tip.
131-0258-00	Chassis Mount Test Jack.
131-4353-00	Circuit Board Test Point, package of 25.
166-0404-01	Insulating Ground Cover.
175-0124-01	5 in. Clip-on Ground Lead.
175-0125-01	12 in. Clip-on Ground Lead.
175-0263-01	3 in. Clip-on Ground Lead.
175-0849-00	3 in. Probe Tip Cap Lead for All Miniature Size Probe Tips.
175-0849-01	6 in. Probe Tip Cap Lead for All Miniature Size Probe Tips.
195-6176-00	3 in. Probe Tip Clip-on Lead for All Miniature Size Probe Tips.
196-3120-00	6 in. Clip-on Ground Lead.
196-3121-00	12 in. Clip-on Ground Lead.
196-3198-00	6 in. Clip-on Ground Lead (with 0.025 in. pin receptacle).
196-3286-00	8 in. Ground Lead.
196-3287-00	#6-32 Thread Ground Lead.
196-3302-00	6 in. Slip-on Ground Lead (with 0.025 in. pin receptacle).
206-0114-00	Hook Tip.
206-0193-00	Flex Tip for 0.025 in. Square Pin.
206-0209-00	Pin Tip (accepts 0.025 in. IBM SLT pin).
214-0283-00	Electrical Ground Contact.
214-4125-00	Electrical Contact Ground.
344-0046-00	#6-32 Thread Alligator Ground Clip.
352-0351-00	Probe Holder, Self-adhesive Back, Black.

SMD ATTACHMENT TOOLS

206-0364-00	SMT KlipChip™ (used with 0.025 pin receptacles).
SMG 50	Package of 20 each SMT KlipChip Adapters.
SMK4	Micro KlipChip™ Adapter (4 each).

See pages 472 to 477 for complete selection of SMD Tools.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

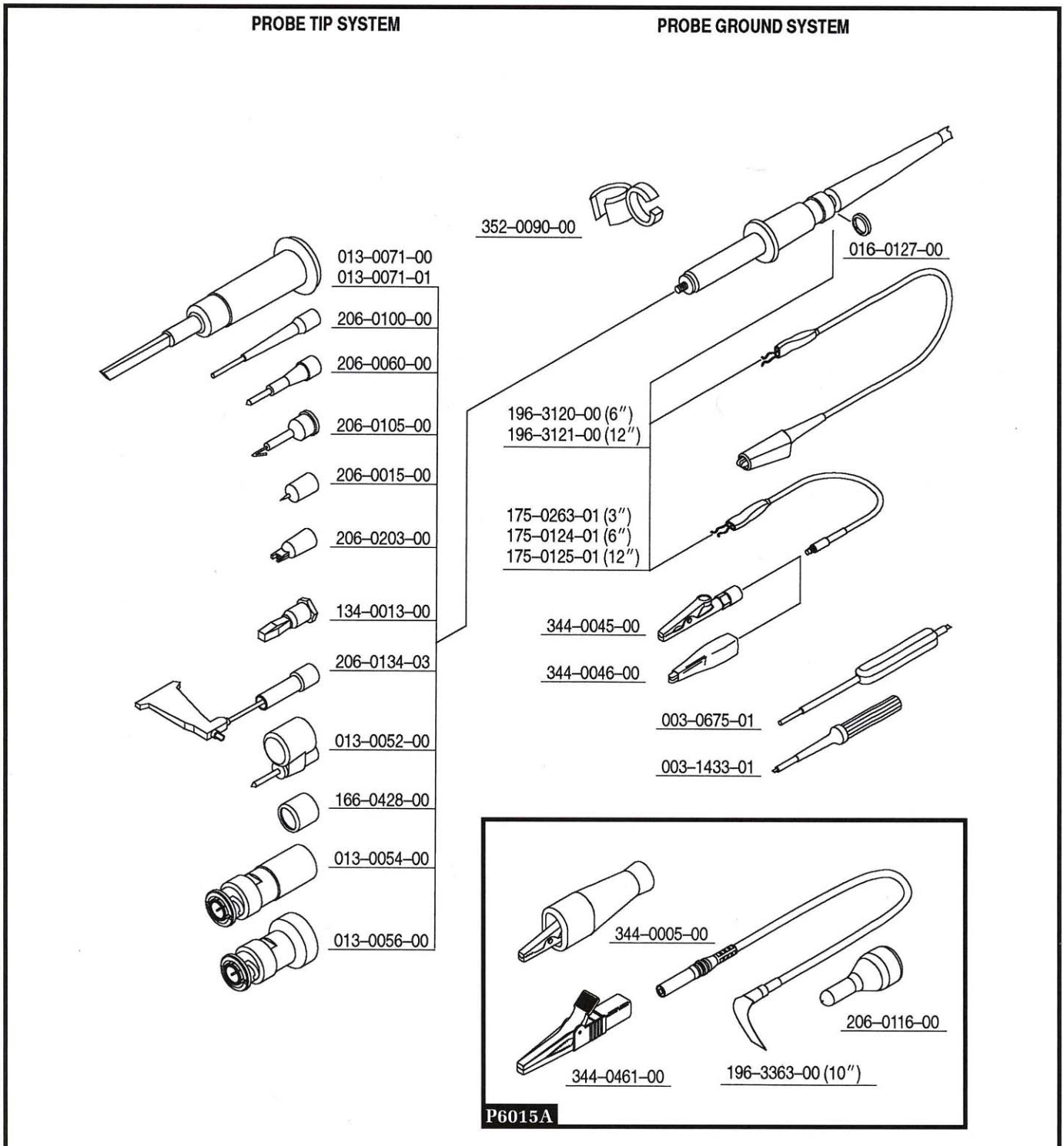
See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

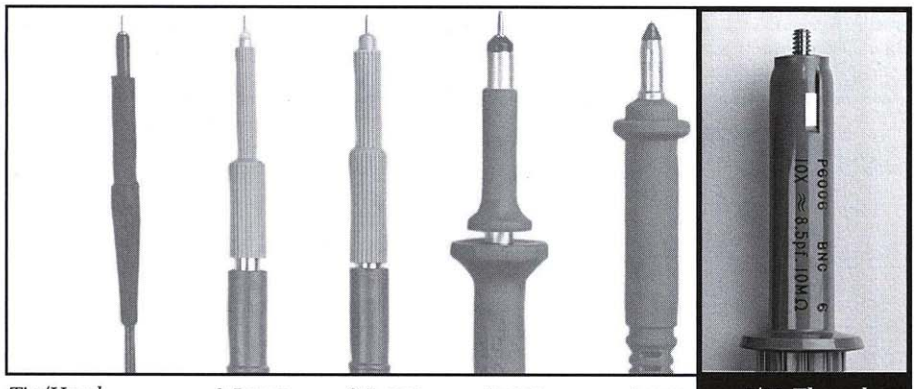
6/32 Thread (Monolithic) • P6015A • P6201



6/32 Thread (Monolithic) Accessories for P6006, P6007, P6008, P6009, P6028, P6060

Probe Accessories

6/32 Thread (Monolithic) • P6015A • P6201



Tip/Head Style: *SMD* *2.5 mm Subminiature* *3.5 mm Compact* *5 mm Miniature* *4 mm*

6/32 Thread Monolithic

ORDERING INFORMATION

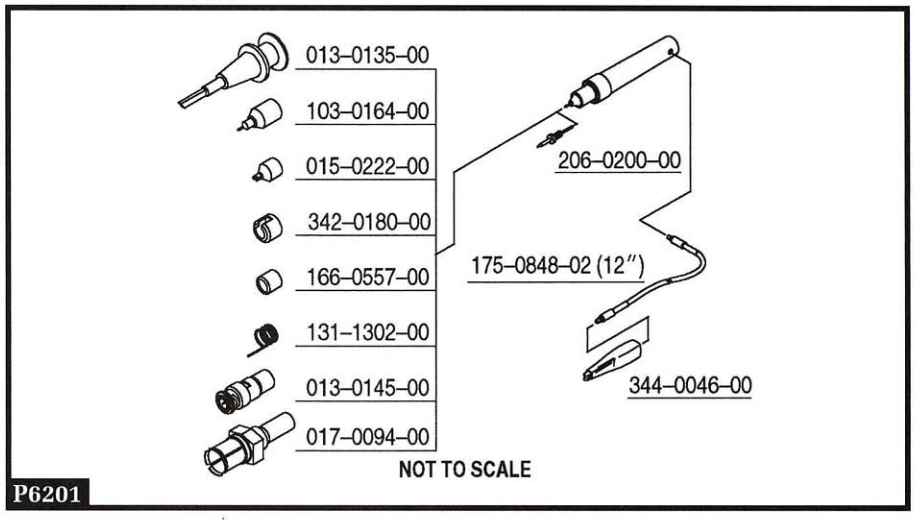
For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

MONOLITHIC PROBE ACCESSORIES
(For probes with #6-32 Screw Tips)

Part Number	Description
003-0675-01	Adjust Tool.
003-1433-00	Adjust Tool.
003-1433-01	Adjust Tool, pkg. of 5.
013-0052-00	Bayonet Ground Assembly.
013-0054-00	Probe Screw Tip to BNC Adapter.
013-0056-00	Probe Screw Tip to BNC Adapter for P6028.
013-0071-00	Retractable Hook Tip.
013-0071-01	Retractable Hook for P6008 Environmental Probe.
134-0013-00	Banana Tip (#6-32).
166-0428-00	Insulating Ground Cover for P6009.
175-0124-01	5 in. Ground Lead.
175-0125-01	12 in. Ground Lead.
175-0263-01	3 in. Ground Lead.
196-3120-00	6 in. Clip-on Ground Lead.
196-3121-00	12 in. Clip-on Ground Lead.
206-0015-00	Straight Tip (0.055 in. dia.).
206-0060-00	Spring Tip (0.08 in. dia.).
206-0100-00	Calibration Tip (0.063 in. dia.).
206-0105-00	Hook Tip.
206-0134-03	Pin Tip (accepts 0.025 in. IBM SLT pin).
206-0203-00	IC Test Tip.
344-0045-00	Alligator Clip.
344-0046-00	Miniature Alligator Clip with Boot.

P6015A

Part Number	Description
344-0461-00	Crocodile Clip, 4 mm Socket.
352-0090-00	P600X Probe Holder.
196-3363-00	10 in. Clip-on Ground Lead for P6015A.
206-0116-00	Banana Tip (P6015 only) #10-32.



P6201 PROBE

Part Number	Description
013-0135-00	Retractable Hook Tip.
013-0145-00	Probe Tip to BNC Adapter.
015-0222-00	IC Test Ground Cover.
017-0094-00	Probe Tip to GR 50 Ω Termination Adapter.
103-0164-00	Probe Tip to Miniature Probe Tip Adapter. (See page 486 for compatible accessories.)
131-1302-00	Ground Contact.
166-0557-00	Insulating Ground Cover.
175-0848-02	12 in. Ground Lead.
195-4341-01	Ground Lead.
206-0200-00	Replaceable Probe Tip.
342-0180-00	Ground Contact Insulator.
344-0046-00	#6-32 Thread Alligator Ground Clip.

CABLE MARKER SETS

016-0127-00 For 3/16 in. dia. Cable.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

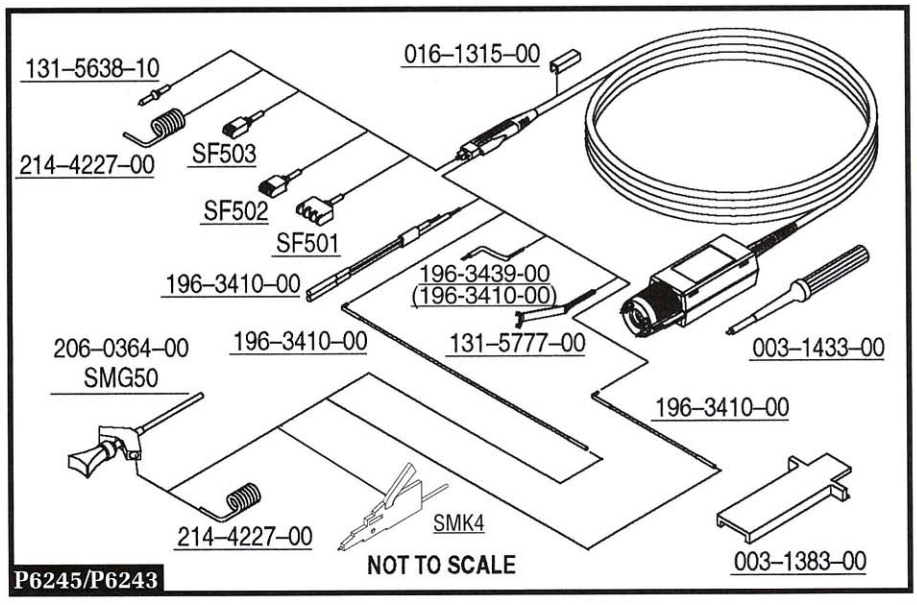
P6245 • P5100 • P5102

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6245/P6243

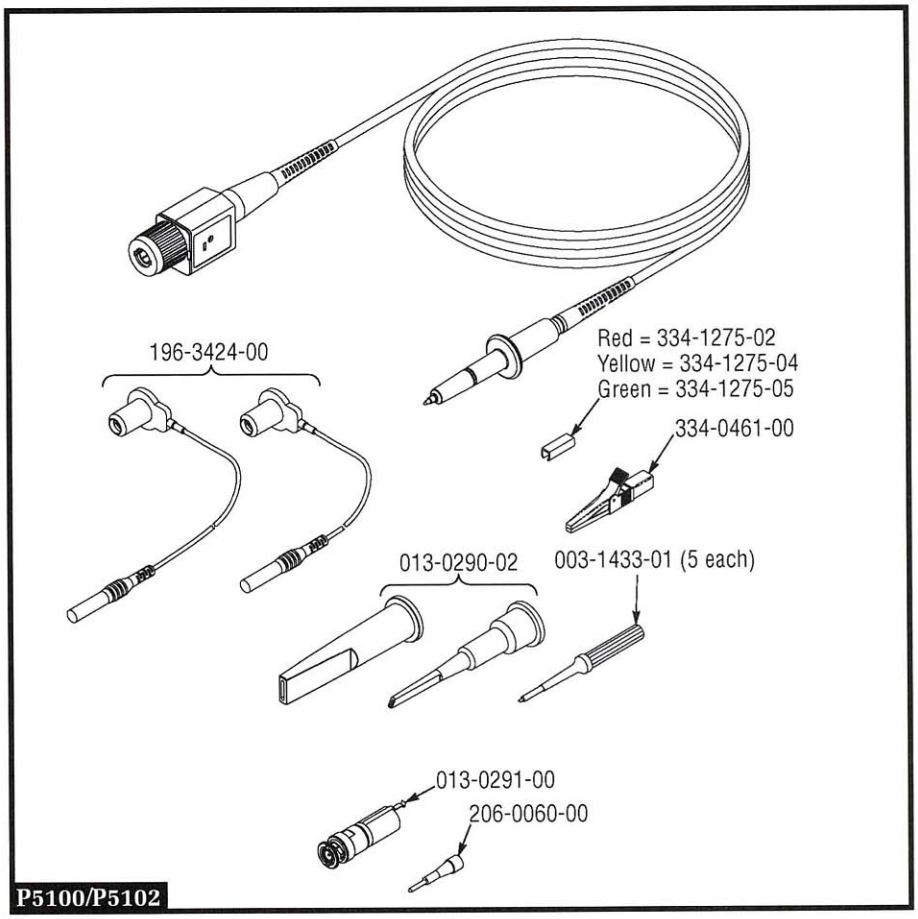
Part Number	Description
003-1383-00	Compensation Box Cover Removal Tool.
003-1433-00	Adjustment Tool.
003-1433-01	Package of 5 each of 003-1433-00.
016-1315-00	2 each – 5 Colors of Cable Markers.
131-5638-10	10 each – Solderable Probe Tips.
131-5777-00	100 mil Square-pin Ground Adapter.
196-3410-00	Ground lead set includes: 2 each – 1 in., 3 in., 6 in. Ground Leads w/Square Pin Receptacle; 2 each – Y Lead Adapters.
206-0364-00	SMT KlipChip™, 1 each.
214-4227-00	Right Angle Square-pin Adapter.
SF501	SureFoot® Probe Tip Adapter, pkg. of 12, Yellow, 50 mil Pitch.
SF502	SureFoot Probe Tip Adapter, pkg. of 12, Blue, 25 mil/ 0.65 mm Pitch.
SF503	SureFoot Probe Tip Adapter, pkg. of 12, Red, 0.5 mm pitch.
SMG50	SMT KlipChip, 20 each.
SMK4	Micro KlipChip Adapter, 4 each.
196-3439-00	1 in. ground lead



P6245/P6243

P5100/P5102

Part Number	Description
020-2137-01	P5100/P5102 Accessory Kit Includes: Regular Retractable Hook Tip, Large Retractable Hook Tip, 6 in. Ground Lead w/Alligator Clip, 18 in. Ground Lead w/4 mm Shielded Banana Plug, Large Crocodile Clip.
196-3424-00	Common Lead Set. 6 in. and 18 in.
003-1433-01	Package of 5 each of 003-1433-00, above.
013-0290-02	Hooktip Set, Large and Small.
013-0291-00	P5100 Probe Tip to BNC Adapter.
016-0127-00	Cable Marker Set.
206-0060-00	Spring Tip (0.08 in. dia.).
344-0461-00	Large Crocodile Clip.
334-1275-XX	Cable Markers.



P5100/P5102

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Power Measurements

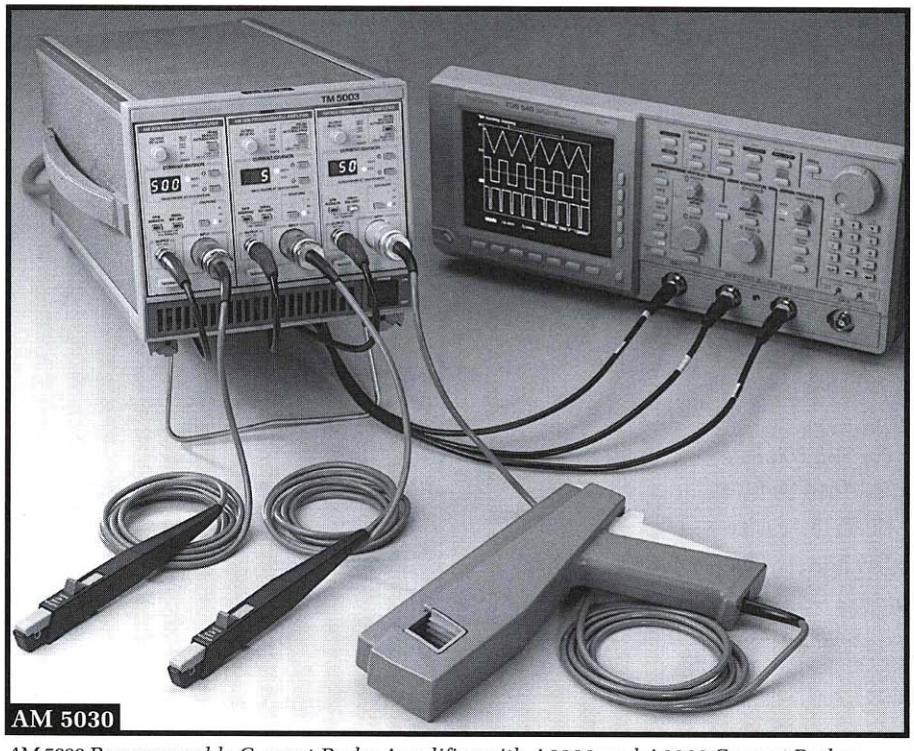
Features

POWER MEASUREMENTS

- High Voltage
- Isolation
- Differential
- Current

Applications

- Power Supplies
- Motor Drives
- Electronic Ballast
- Power Converters
- Power Device Evaluation
- Switch Mode Control
- UPS Systems



AM 5030 Programmable Current Probe Amplifier with A6302 and A6303 Current Probes.

Power Measurements

Oscilloscopes measure voltages, presented at their inputs, to provide amplitude versus time displays and offer a wide range of analysis capabilities. These voltage signals are typically referenced to ground and less than 500 V. While providing valuable information about what is occurring in your device, it is clear that knowledge of currents, high voltages, and floating voltages may all be required to completely understand what is happening with your application.

In the following sections we describe a selection of probes and devices which enable you to safely and accurately capture current, high voltage, and floating signals – all converted to voltage inputs acceptable to your oscilloscope or other measurement instrument.

While current and differential voltage measurements are important to most electrical and electronic applications, higher current and voltage and isolated floating measurements are especially critical in power conversion applications. These applications include devices characterized by high currents and differential voltages which change rapidly as the devices switch on and off. In these applications, safety as well as accuracy is of critical importance. The special needs of these applications are addressed by the group of products we refer to as power measurement products.

In the following pages we describe each category of measurement products: current probes, high voltage probes, monolithic isolators, fiber optic isolation systems, and differential probes.

In each section, we describe product features and applications. We also provide information to help you select the right device to safely and accurately make your measurement. We will also provide valuable Data Sheets on how to make measurements specific to your application.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

High Voltage Probes

P5100 • P5102 • P6015A • P850

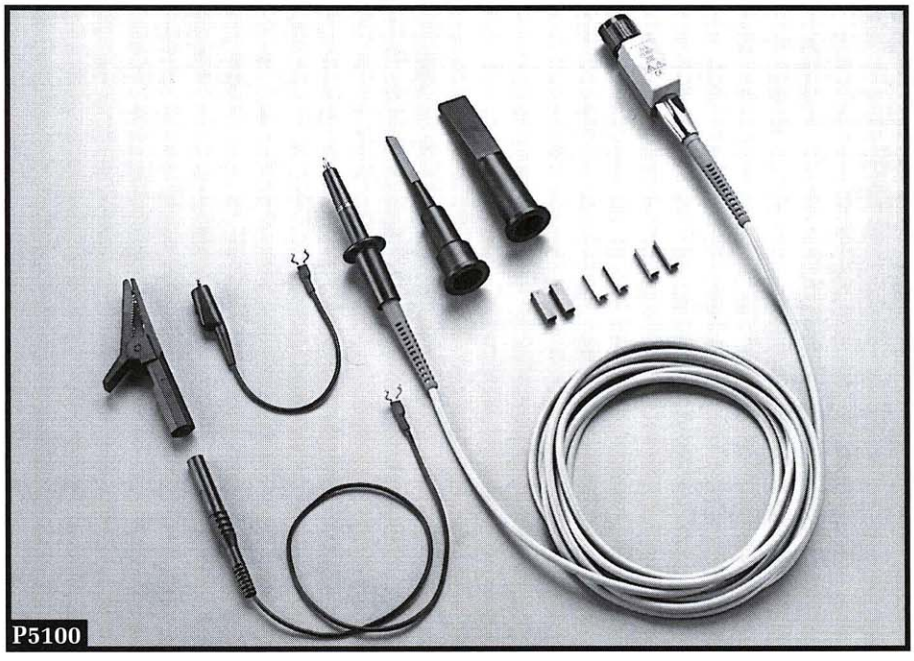
Features

P5100
- DC to 250 MHz
- 2500 V DC + Peak AC
- 100X with Readout
- UL 3111-1 Listed
- IEC 1010 Certified
- 7-30 pF Compensation Range

P5102
- 100 MHz
- 10X
- For THS 700 Series
- IEC 1010 Certified
- UL 3111-1 Listed
- See page 466 for complete information

P6015A
- High Voltage – 20 kV DC/40 kV Peak (100 ms Pulse Width)
- High Bandwidth – 75 MHz
- Silicone Dielectric
- Optional 1,000X Coding
- Wide Compensation Range (7-49 pF)
- Heavy Duty Versatile Ground Lead and Clip

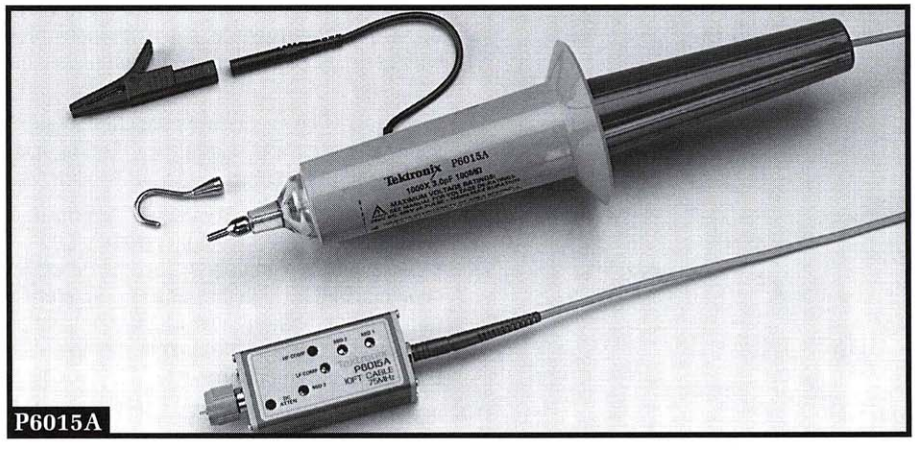
P850
- 10X
- DC to 60 MHz
- UL 1244 Listed
- For 22X Series


P5100

P5100 High Voltage Probe

The P5100 is a low-input capacitance High Voltage (2.5 kV) Probe designed for higher frequency applications. The probe can be compensated to match plug-ins and oscilloscopes with nominal input capacitances of 7-30 pF. A variety of screw-on accessories provide easy connection to the device under test.

For additional information on P5100 request Data Sheet 56W-10262-1.



P6015A

P6015A High Voltage Probe

For heavy duty high-performance measurements of voltages over 2.5 kV, the P6015A is the industry standard. You can measure DC voltages up to 20 kV and pulses up to 40 kV. The 75 MHz bandwidth enables you to capture fast, high-voltage signals.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(except P6015A, P850)*

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

High Voltage Probes

P5100 • P5102 • P6015A • P850

The P6015A uses an environmentally safe silicone compound for a dielectric and never needs refilling. Other features include: a 7-49 pF compensation range, small compensation boxes which fit on adjacent amplifier inputs, and a readout option for use with Tektronix digital scopes. With the readout option, displayed voltage amplitude values will be the actual signal value rather than understated by a factor of 1,000. Using the readout version with other than Tektronix digital scopes may result in an erroneous readout display.

For additional information on the P6015A, request P6015A Data Sheet 51W-8217-1.

CHARACTERISTICS

P6015A/P5100/P5102

Probe	Nominal Length	Attenuation	Bandwidth	Rise Time	Loading	Max Input V	Compensation Range In pF DC or RMS	Readout
P6015A	10 ft.	1000X	75 MHz	4.0 ns	100 MΩ/3 pF	20 kV	7 to 49	No
P6015A Opt. 1R	10 ft.	1000X	75 MHz	4.0 ns	100 MΩ/3 pF	20 kV	7 to 49	Yes
P6015A Opt. 25	25 ft.	1000X	25 MHz	14 ns	100 MΩ/4 pF	20 kV	7 to 49	No
P6015A Opt. 2R	25 ft.	1000X	25 MHz	14 ns	100 MΩ/4 pF	20 kV	7 to 49	Yes
P5100	10 ft.	100x	250 MHz	1.75 ns	10 MΩ/2.75 pF	2.5 kV	7 to 30	Yes
P5102	2 m	10X	100 MHz	≤3.5 ns	5 MΩ/11.2 pF	1,000 VRMS	24 to 28	No

P850

	Nominal Length	Attenuation	Loading	Bandwidth			Max Input V		
				222A	222PS	224	222A	222PS	224
P850*1	3.5 ft.	10X	10 MΩ/4.5 pF	10 MHz	10 MHz	60 MHz	400 V	850 V	850 V

**1 The P850 is rated for 6 kV peak surge (≤250 µS) when used with the 222PS and 224, but not for the 222A.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P5100
100X, 10 ft. High Voltage Probe.
Includes: Two each three colors Cable Markers, One each Crocodile Clip, One each Adjustment Tool, One each Hooktip (Small), One each Hooktip (large), One each 18 inch Ground Lead, One each six inch Ground Lead, Instruction Manual (070-8151-00).

RECOMMENDED ACCESSORIES
Probe Tip to BNC Adapter – Order 013-0291-00.

0.080 in. Diameter Spring Tip – Order 206-0060-00.

Differential Probe Pair Kit – 2 Differential Ground Leads; 1 Long and 1 Short (either connects the probe grounds together at the tips). 12 "S" Clips (clips hold the ends of the probes together). Instruction Sheet (includes a procedure for twisting the probe leads together and adjusting the probes to maximize CMRR). Order 040-1487-00.

P5102
10X, High Voltage Probe for THS 700 Series.
See page 466 for complete information.

P6015A
1,000X, 10 ft. High Voltage Probe.
Includes: Hook Probe Tip (206-0463-00); Banana Plug Tip (134-0016-00); Crocodile Clip – plugs onto Ground Lead (344-0461-00); Ground Lead (196-3363-00); Carrying Case (016-1147-00); Instruction Manual (070-8223-02).

Opt. 1R – 10 ft. with Readout.

Opt. 25 – 25 ft. without Readout.

Opt. 2R – 25 ft. with Readout.

MEASUREMENT SERVICE OPTIONS
Opt. R3 – Repair warranty extended to cover three years (P6015A only).
Opt. R5 – Repair warranty extended to cover five years (P6015A only).

RECOMMENDED ACCESSORIES:
See page 490.

P850
10X, 3.5 ft. Voltage Probe.
Includes: Ground Lead (196-3337-00); Accessory Kit (020-1908-00); Data Sheet (063-0634-00).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(except P6015A, P850)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Floating Measurements

Features

P6246/P6247 – TEKPROBE®
- Active Differential Probe
- 400 MHz/ 1GHz

ADA400A – TEKPROBE
- Active Differential Preamplifier
- Selectable Gain of 100, 10, 18, 0.1
- Selectable Low Pass Filters of 100 Hz, 3 kHz, 1MHz
- 1 MHz

P5200
- Active Differential Probe
- 1300 V Differential (DC + Peak AC)
- 25 MHz

P5205 – TEKPROBE
- Active Differential Probe
- 1300 V Differential (DC + Peak AC)
- 100 MHz

P5210 – TEKPROBE
- Active Differential Probe
- 5600 V Differential (DC + Peak AC)
- 50 MHz

P6135A
- Differential Probe Pair
- High CMRR with All Tektronix Differential Amplifiers

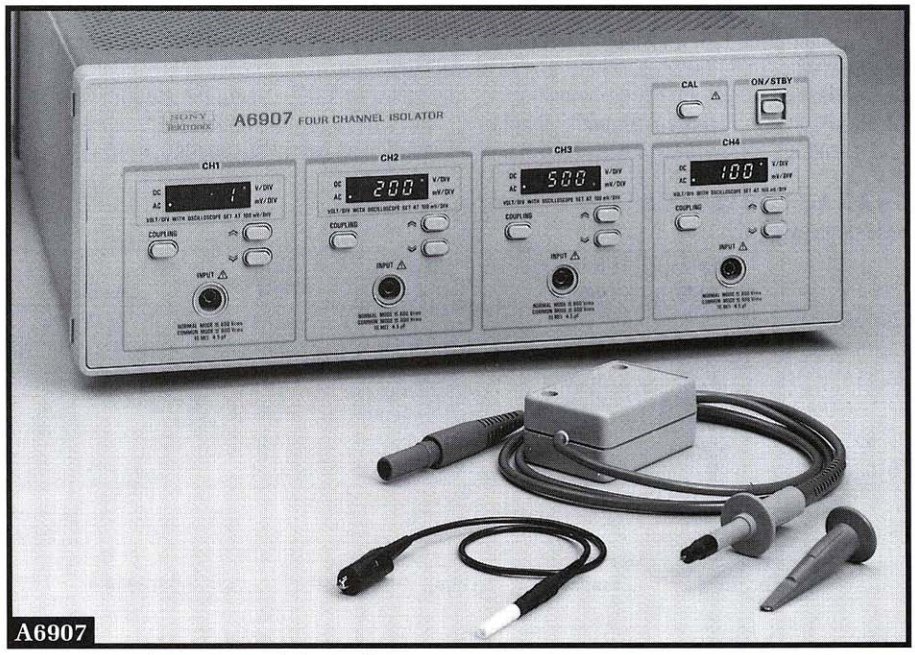
A6906S
- Fiber Optic Isolation System
- High Performance Measurements
- 100 MHz

A6907
- Monolithic Voltage Isolator
- 4 Channel
- 60 MHz

A6909
- Monolithic Voltage Isolator
- 2 Channel
- 60 MHz

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com



A6907 Four Channel Monolithic Isolator.

Floating Measurements

Differential probes and isolators enable safe oscilloscope measurements of floating voltages or signals that are not referenced to ground. They are particularly useful for measuring signals in line-connected power electronics circuits such as switching supplies, motor drives, ballasts and uninterruptible power sources. Fiber optic isolators offer the additional benefit of physically separating the scope from the probe by up to 200 meters while maintaining up to 100 MHz of signal bandwidth.

Oscilloscope users often have to make measurements where neither point of the measurement is at ground (earth potential). Signal "common" may be elevated to hundreds of volts from ground. In addition, many of these measurements require the rejection of high common mode signals in order to evaluate low level signals riding on them. Extraneous ground currents can also add hum to the display. Too often, these problems force users into using dangerous measurement techniques.

For safe and accurate operation, an oscilloscope must be referenced to ground. "Floating" a scope by defeating the scope's protective grounding system not only presents a danger to the operator because of high voltage shock hazard on the entire scope, but also stresses the scope's power transformer insulation. Measurement accuracy is also degraded since the capitance of the scope chassis is now connected to your circuit. Common ways of defeating the scope ground are: non-monitored isolation transformers, isolating circuits and the traditional cutting off the ground prong or using a 3-to-2 wire adapter. All of these are dangerous!

Even when a measurement is ground referenced a differential measurement solution may be necessary for eliminating ground loops or ground bounce problems.

Fortunately, there are several solutions available which are not only safe but much more accurate than the dangerous procedures. These fall into three general categories: isolation amplifiers, differential measurement systems, and isolated input oscilloscopes.

For more information contact your local Tektronix representative and ask for "Differential Oscilloscope Measurements" publication #51W-10540-0.

Floating Measurements

ISOLATION AMPLIFIERS

An isolation amplifier is connected between the circuit and the oscilloscope with the signal coupled across an isolation barrier. The A6906S Fiber Optic System provides both isolation and physical separation for signals up to 850 V by using fiber optic cable as the isolation medium. This also enables up to 200 meters of physical separation between the probe and the measurement instrument. The monolithic four and two channel A6907/A6909 use electro-optical/transformer isolation and are also rated for up to 850 V.

DIFFERENTIAL MEASUREMENT SYSTEMS

Differential measurement systems compare the voltage levels at two different points in the circuit and provide the difference as an output. They will typically have better CMRR performance at higher frequencies than voltage isolators. The P6246/P6247 w/1103, P5200, and ADA 400A are standalone systems which enable differential measurements to be displayed by Tektronix TDS and most other oscilloscopes. The P6246, P6247, P5205, and P5210 work specifically with scopes with the TEKPROBE® interface. The P6246/P6247 are well suited for fast, lower amplitude signals, while the P5200/P5205/P5210 can handle slower signals with higher voltage amplitudes. The ADA400A Differential Preamplifier provides the capability to display low frequency, very low amplitude differential signals even in high noise environments.

Passive differential probe pairs maximize the performance of differential amplifiers/comparators such as the 11A33. The P6135A supports all Tektronix differential amplifiers for input voltages up to 500 V.

ISOLATED INPUT OSCILLOSCOPES

The **new** 100 MHz THS 700 series of two channel handheld digital storage oscilloscopes enables completely isolated measurements. With the P5102 10X probe, fast signals up to 1000 V can be measured.

The 224 handheld oscilloscope also features dual input channels, individually isolated from the scope's chassis as well as from each other. With the 850 V rated P850 probes, floating measurements can be made safely and accurately.

For more information, request Floating Oscilloscope Measurements… And Operator Protection, 51W-10640-0.

COMMON MODE REJECTION RATIO

Differential measurements, simply stated, show you the difference in levels between two test points. Specifically, a floating measurement is a differential measurement which is not referenced to ground. To accurately make this measurement, the measurement system must reject the signal which is common to both test points and display the voltage difference.

WHAT IS CMRR?

CMRR stands for Common Mode Rejection Ratio. CMRR serves as a figure of merit for a differential amplifier defined by:
$CMRR = |A_d/A_c|$, where:

- A_d is the voltage gain for the difference signal
- A_c is the voltage gain for the common-mode signal

Ideally, A_d should be large, while A_c should equal zero. Since a perfect differential amplifier has a CMRR equal to ∞, the higher the CMRR for the differential measurement system, the closer it is to the ideal. For example, with a system CMRR of 10,000:1, a common-mode input of 5 V will result in an output of 0.5 mV. (5 V / 0.5 mV = 10,000:1 CMRR). CMRR is also expressed in dB with the relationship of: CMRR dB = 20 log CMRR. Hence, a CMRR of 10,000:1 would be 80 dB.

WHY CMRR IS IMPORTANT

CMRR defines the ability of a measurement system to accurately resolve difference measurements in the presence of common-mode signals. With a CMRR of 10,000:1 (80 dB), if our common-mode signal is 50 V, we will be able to distinguish voltage differences > 5 mV. With a CMRR of 100:1(40 dB), however, we would only be able to resolve differences >500 mV.

CMRR is degraded by an increase in signal frequency, differences in source impedance, inappropriate ground connections and mismatch in probes and scope input amplifiers. Since common mode signals in switching circuits contain significant high frequency components, CMRR at higher frequencies is critical for making accurate measurements.

For more information, request Floating Measurements Solutions Selection Guide, 51W-10457-0.

CMRR dB VS RATIO

CMRR Ratio		CMRR dB
100,000:1	=	100 dB
10,000:1	=	80 dB
1,000:1	=	60 dB
100:1	=	40 dB
10:1	=	20 dB

Differential Probes

New P6247 • P6246

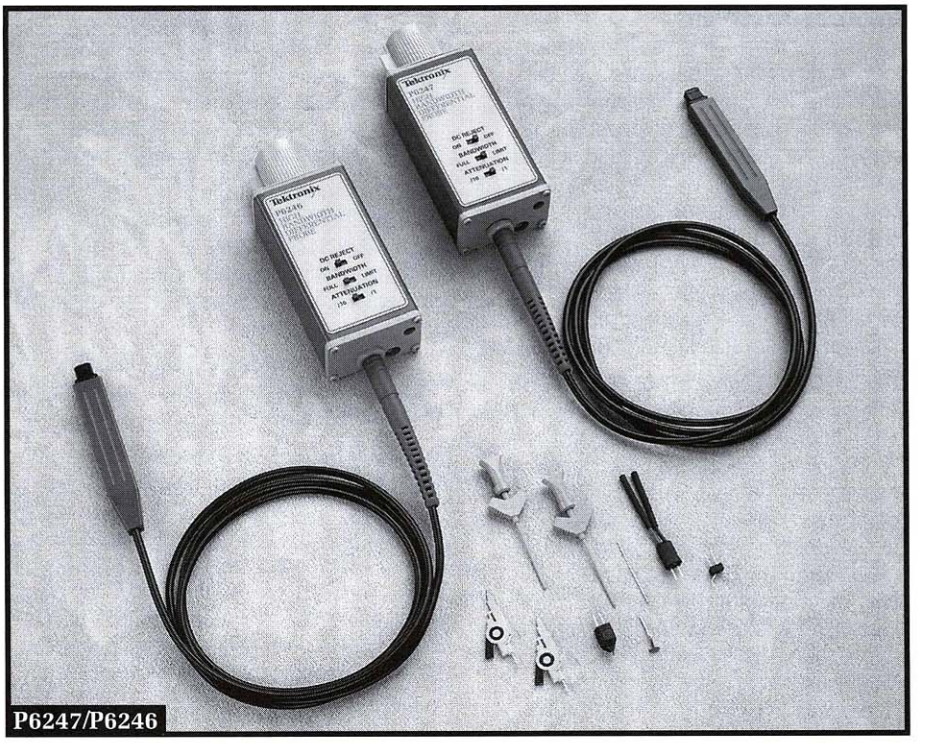
Features

P6247 AND P6246

- >1 GHz/400 MHz Bandwidth
- >70 dB (3160:1) Common Mode Rejection Ratio (CMRR)
- Low Input Capacitance: <1 pF Differential
- Probe Input Connector:Two Standard 0.025 in. (0.1 in. center) Square Pin Receptacle (Female)
- Electrostatic Discharge Tolerant (IEC 801-2)
- Connects to TEKPROBE® Interface on TDS Series Scope, or Other Instruments Using 1103 TEKPROBE Power Supply
- For Use with Oscilloscopes, Spectrum or Network Analyzers, Time Interval Analyzers, and Bit Error Rate Testers

Applications

- Semiconductor Characterization
- Disk Drive Read Channel Design
- Communication Pulse Shape Compliance
- Jitter, Cross-Talk, BERT Measurements
- Location of Ground Bounce



The P6246 and P6247 Differential Probes

The P6246 and P6247 enable users to make time domain or frequency domain measurements on high bandwidth signals commonly found in disk drive, digital IC design, and communication applications. The small probe head geometry and assorted probe tip accessories allow these probes to easily accommodate manual probing of surface mount devices while maintaining high CMRR.

The P6246 and P6247 are ideal for design verification of disk drive read channel electronics and timing analysis or for troubleshooting ground bounce problems associated with high speed logic. They can also be used for pulse shape or cross talk compliance testing of high speed communication signals.

Characteristics

WARRANTED SPECIFICATIONS

Bandwidth –
P6247: DC to 1.0 GHz
P6246: DC to 400 MHz.

Rise Time –
<350 ps (P6247), <875 ps (P6246).

Attenuation –
Switchable: ÷1.0, ÷10.0.

DC Attenuation Accuracy – ±2%.

Common Input Voltage Range –
±7.0 V, ÷1; ±7.0 V, ÷10.

Differential Input Voltage Range –
±850 mV, ÷1; ±8.5 V, ÷10.

Max. Non-Destruct Input Voltage –
±25 V (DC + peak AC).

Electrostatic Immunity – >15 kV.

TEKPROBE Interface – Probe power, autoscaling, auto-termination with TDS scopes.

Bandwidth Limit – Switchable, 200 MHz.

DC Reject – 0.4 Hz, ÷1; 4.0 Hz, ÷10.

TYPICAL SPECIFICATIONS

Common Mode Rejection Ratio (CMRR)–
>70 dB at ≤1 MHz
>50 dB at ≤100 MHz
>30 dB at ≤500 MHz
>30 dB at ≤1 GHz.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Differential Probes

New P6247 • P6246

Input C –
<1 pF (differential mode),
<2 pF (common mode).

Input R –
200 kΩ (differential mode),
100 kΩ (common mode).

Linearity – ±2%.

Noise – <50 nV/$\sqrt{Hz}$.

Harmonic Distortion – ≤1.5% @ 100 MHz.

Passband Ripple – <±0.25 dB.
P6247: DC to 850 MHz.
P6246: DC to 400 MHz.

Output Termination –
Terminate into 50 Ω.

PHYSICAL CHARACTERISTICS

Weight (probe only) – 160 g (0.36 lb).

Probe Head Volume – 6 cm^3 (0.3 $in.^3$).

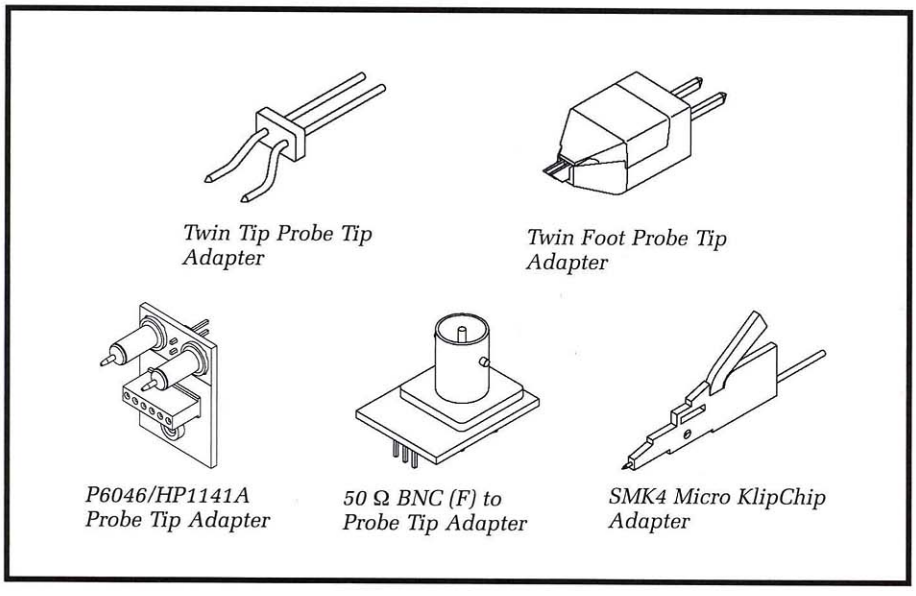
Probe Head Input Connection – 0.63 mm (0.025 in.) square pins on 2.54 mm (0.1 in.) centers.

Output Cable Length – 1.2 m (4.0 ft.).

ENVIRONMENTAL CHARACTERISTICS

Temperature –
Operating 0 to 60°C.
Non-operating –55 to +75°C.

Humidity (0 to 90% RH) –
Operating 30 to 50°C.
Non-operating 30 to 60°C.



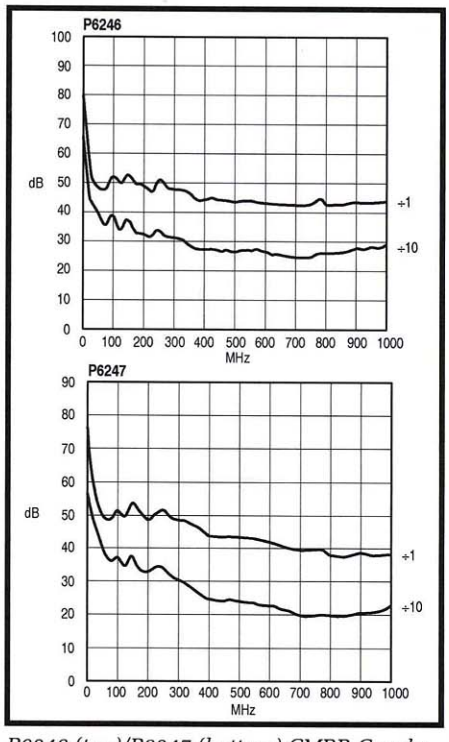
Twin Tip Probe Tip Adapter

Twin Foot Probe Tip Adapter

P6046/HP1141A Probe Tip Adapter

50 Ω BNC (F) to Probe Tip Adapter

SMK4 Micro KlipChip Adapter



P6246 (top)/P6247 (bottom) CMRR Graphs.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6247
Differential Probe

P6246
Differential Probe

Both Include: P6247/P6246 Probe Tip Accessory Kit (020-2203-00), 6 in. ground lead, spring-loaded ground pin (2 ea.), short ground contact (2 ea.), twin tip adapter (2 ea.), twin foot adapter (2 ea.), SMT KlipChip Adapter (3 ea.), Micro KlipChip Adapter (2 ea.), probe tip to BNC adapter, Y-lead adapter.

Hard Case – P6247 Order 006-7340-00, P6246 Order 016-0156-03.

Certificate of Traceable Calibration

User Manual Set –
English, German, French, and Japanese. Order 070-9898-00.
English. Order 070-9899-00.

MEASUREMENT SERVICE OPTIONS

Opt. 95 – Calibration Data.

Opt. R3 – 3 Years Extended Warranty.

Opt. C3 – 3 Years Calibration Services.

RECOMMENDED/REPLACEMENT ACCESSORIES

Probe Tip Accessory Kit – Order 020-2203-00.

Twin Tip Probe Tip Adapters – 4 each. Order 013-0305-04.

Twin Foot Probe Tip Adapters – 4 each. Order 013-0306-04.

SMK4 Micro KlipChip™ Adapters – 4 each.

P6046/HP1141A Probe Tip Adapter – Order 013-0304-00.

50 Ω, BNC (M) to BNC (M) Coaxial Cable – 18 in. Order 012-0076-00.

50 Ω, BNC Coaxial Terminator – Order 011-0049-01.

50 Ω, SMA (F) to BNC (M) Adapter – 015-0572-00.

RELATED PRODUCT

1103 – TEKPROBE® Power Supply w/ standard North America/Japan Power Cord. (See page 456).

Opt. A1 – Europe Power Cord.

Opt. A2 – UK Power Cord.

Opt. A3 – Australia Power Cord.

Opt. A4 – Switzerland Power Cord.

Opt. A6 – Japanese Power Cord.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

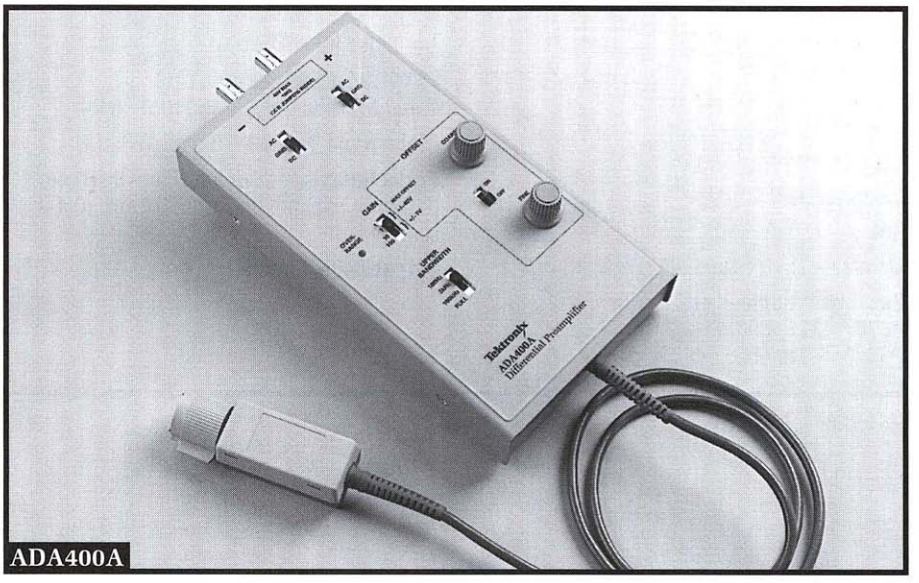
Differential Preamplifier
ADA400A

Features

ADA400A
- Active Differential Preamplifier
- 10 µV/div Sensitivity
- Typically 100 dB CMRR DC to 10 kHz
- Integral Probe Power with TEKPROBE® BNC

Applications

- Biomedical Research
- Medical Equipment
- Mechanical Analysis
- Audio Design



ADA400A

ADA400A

The ADA400A Differential Preamplifier allows direct oscilloscope measurements of very low amplitude voltages and signals which are not ground referenced. The high impedance of both inputs eliminates the need to add additional ground points in the DUT, thereby avoiding circulating currents which disturb the measurement or the circuit.

The high gain and extremely high common mode rejection provide usable measurements of voltages as low as 5 µV, even in high noise environments. Selectable bandwidth limiting reduces normal mode noise from digital logic, switch mode power supplies, and line frequency sources. Adjustable differential offset allows the user to null out transducer bridge bias and galvanic potential from the test setup. An "infinite impedance" mode can be selected in the two highest gain ranges allowing accurate measurements of signals with high source impedance. Special circuitry greatly reduces annoying DC drift common in older differential preamplifiers.

The ADA400A is powered directly from TDS 400, TDS 500, TDS 600, and TDS 700 Series oscilloscopes. It can also be used with other oscilloscopes when powered by a 1103 Probe Power Supply.

Characteristics

Gain – X100, X10, X1, X01.

CMRR – ≥100,000:1 DC - 10 kHz.

Gain	CM Range	Differential Range*1	MAX Offset
100	±10 V	0.1 V	±1.0 V
10	±10 V	1 V	±1.0 V
1	±40 V	10 V	±40 V
0.1	±40 V	80 V	±40 V

**1 For higher voltages, attenuating probes may be used, but CMRR performance will be degraded.*

Bandwidth Limits – 100Hz, 3 kHz, 100 kHz, Full (≥1 MHz).

Input Impedance – 1 MΩ || ~ 50 pF (∞Ω Selectable in 100X and 10X gains).

Noise – Typically ≤30 µV RMS @ X100 Gain (Referred to Input).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ADA400A
Differential Preamplifier.
Includes: 070-9164-00 Instruction Manual, 159-0024-00 Spare Input Fuses (2).

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

RECOMMENDED ACCESSORIES
P6101B 1X Passive Probe (2 recommended).

Differential Probes
P6135A

Features

P6135A

- Attenuation Adjustable to 10X
- 10,000: 1 CMRR on 11A33 Differential Comparator; 20,000: 1 on 7A13 Differential Amplifier
- ±500 V Maximum Common Mode Voltage
- Matched Pair

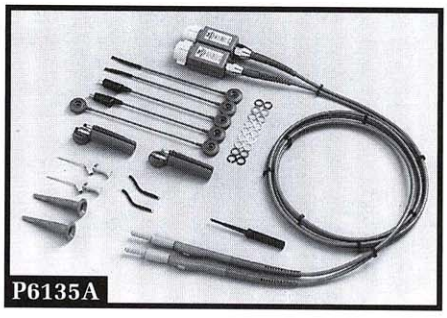
Applications

- Power Supplies
- Disk Drives
- Electronic Ballast
- Intelligent Motion
- Adjustable Speed Drives

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Tektronix Measurement products are manufactured in ISO registered facilities.



P6135A Differential Probe Pair

The P6135A 10X Differential Probe Pair is specifically designed to obtain the maximum in performance from a Tektronix differential measurement system. With differential amplifiers the P6135A provides CMRR ratios up to 20,000:1. Since a single 10X probe with accuracy of 1% or less gives a scope-to-probe CMRR of no better than 50:1, the P6135A is essential to obtain accurate results from your differential amplifier. Three pairs of carefully matched, precision-engineered hybrid tips enable the P6135A to be specifically matched with all Tektronix 11000, 7000 and 5000 Series differential amplifiers and comparators. It also provides excellent performance when used with plug-in amplifiers or oscilloscopes having input impedances of 1 MΩ/13-15 pF, 1 MΩ/18-22 pF and 1 MΩ/45-49 pF.

DIFFERENTIAL PROBE PAIRS

The P6135A differential probe pair is very carefully matched to minimize differences in capacitance and resistance (to minimize differences in impedance) and length (to minimize signal delay differences). Additionally, the attenuation adjusts to compensate for any remaining differences in the probes as well as differences in the attenuation of the plug-in or scope amplifier.

DIFFERENTIAL AMPLIFIERS/COMPARATORS AND THE P6135A

For high frequency applications, the P6135A with the 11A33 Differential Comparator provides a maximum bandwidth of 150 MHz and a minimum CMRR of 10,000:1 up to 1 kHz, decreasing to 100:1 at 20 MHz. For high CMRR measurements, the 7A13 Differential Amplifier and P6135A have a CMRR of 20,000:1 up to 1 kHz, decreasing to 100:1 at 20 MHz and a maximum bandwidth of 90 MHz. Combined with the ADA 400A, a differential signal can be displayed on a single channel of a TDS Series oscilloscope.

Characteristics

CMRR – On 11A33: 10,000:1 from DC to 1 kHz, derating to 100:1 at 20 MHz. On 7000 Series: 20,000:1 from DC to 1 kHz derating to 100:1 at 20 MHz.

Attenuation – Adjustable to 10X.

Input Resistance – 1 MΩ.

Input Capitance – 10.5 pF on instrument with 15 pF input capitance; 11.0 pF when used with instrument that has 20 pF input capitance; 13.7 pF when used with instrument that has 47 pF input capitance.

Maximum Useful Bandwidth – On 11A33: DC to 150 MHz; On 7A13: DC >90 MHz.

Typical Probe Rise Time – On 11A33: <2.33 ns; On 7A13: <3.89 ns.

Maximum Common Mode Voltage – 500 V (DC + pk AC) from DC to 1.3 MHz, derated to 50 V (DC + pk AC) at 100 MHz.

For more information about the P6135A and differential measurements, request Data Sheet 63W-8103.

Safety – UL 1244 Listed.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6135A
Pair of 10X, 150 MHz Differential Probes. **Includes:** Adjustment Tool (003-1433-00); Two Retractable Hook Tips (013-0107-07); 6 in. Dual-ring Ground Lead (196-3295-00); Accessory Pouch (016-0708-00); Two 6 in. Ground Leads (196-3113-02); Two 6 in. Ground Leads with Alligator Clips (196-3305-00); Two SMT KlipChip™ (206-0364-00); Two Low Inductance GND Collars (343-1003-01); Two Probe Tip Holders (352-0670-00); 2 in. Ground Leads (195-4240-00); Cable Marker Rings; Instruction Manual (070-7675-00).

RECOMMENDED ACCESSORIES
Also see page 484.

Differential Probes

P5200 • P5205 • New P5210

Features

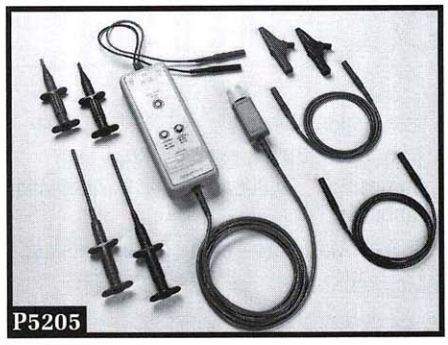
- Bandwidths up to 100 MHz
- Up to 5,600 V Differential (DC + pk AC)
- Up to 2,200 V Common (RMS)
- Overrange Indicator
- Safety Certified
- Switchable Attenuation
- Switchable Bandwidth Limit

Applications

- Floating Measurements
- Switching Power Supply Design
- Motor Drive Design
- Electronic Ballast Design
- CRT Display Design
- Power Converter Design and Service
- Power Device Evaluation

The P5200 can be used with any oscilloscope and enables users to **safely** make measurements of floating circuits with their oscilloscope grounded. The P5200 Active Differential Probe converts floating signals to low voltage ground referenced signals that can be displayed safely and easily on any ground referenced oscilloscope.

The P5210 is a Differential Probe that is capable of measuring floating voltages up to 5,600 V (DC + pk AC) **safely** and has a bandwidth up to 50 MHz. It is supplied with two sizes of hook tips and has an overrange visual and oral indicator which warns the user when they are exceeding the linear range of the probe. It can be used with Tektronix TEKPROBE® interface oscilloscopes directly or with any oscilloscope with the use of the 1103 TEKPROBE Power Supply.



The P5205 is a 100 MHz Active Differential Probe capable of measuring fast rise times of signals in floating circuits. This 1300 V differential probe can measure **safely** voltages in IGBT circuits such as motor drives or power converters. It is specifically designed to operate on Tektronix oscilloscopes with TekProbe interface.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

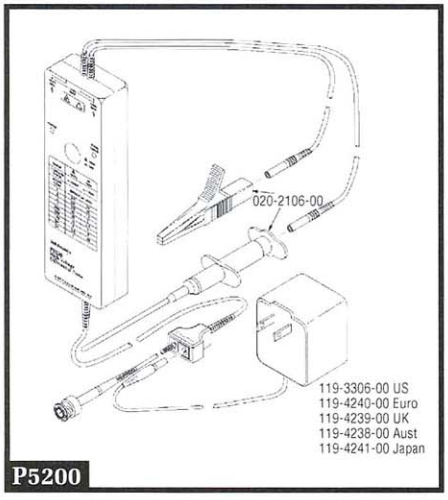
See Tektronix on the World Wide Web: http://www.tek.com

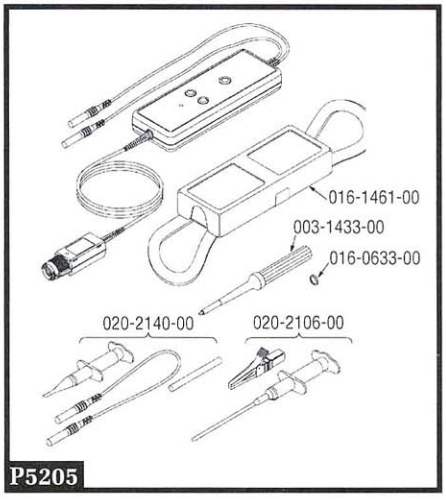
CE *(except P5200/P5205)*

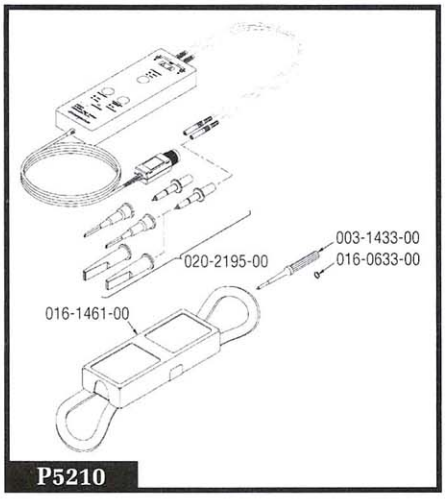
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Differential Probes

P5200 • P5205 • New P5210







Specifications	P5200	P5205	P5210
Differential Voltage DC + pk AC	1,300 V	1,300 V	5,600 V
Bandwidth (–3 dB)	25 MHz	100 MHz	50 MHz
Common Mode Voltage DC + pk AC	1,300 V	1,300 V	5,600 V
Common Mode Voltage RMS CAT II	1,000 V	1,000 V	2,200 V
Common Mode Voltage RMS CAT III	600 V	600 V	1000 V
Attenuation (switchable)	50X/500X	50X/500X	100X/1000X
CMRR @ 60 Hz/1 MHz	80 dB/50 dB	80 dB/50 dB	80 dB/50 dB
Input R (each input)	4 MΩ	4 MΩ	8 MΩ
Input C (each input)	7 pF	7 pF	7 pF
Power Source	AC wall adapter	TEKPROBE®	TEKPROBE®
Certification	UL3111/IEC1010	UL3111/IEC1010	UL311/IEC1010
Compatible Products	ALL	TDS 400/500/600/700 and 11000 Series	TDS 400/500/600/700 and 11000 Series

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P5200
Active Differential Probe.
Includes: 2 Crocodile Clips; 2 Plunger Clips; 9 V DC Power Supply; Manual (070-9018-00).

INTERNATIONAL POWER PLUG OPTIONS (P5200 ONLY)

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

Opt. A6 – Japan 100 V, 50 Hz.

See Customer Information Section for additional description.

P5205
Active Differential Probe.
Includes: 2 each Plunger Clamps; 2 each Crocodile Clips; 2 each Extender Leads; 2 each Lead Adapters; 2 each Plunger Hook Clips; Soft Case; Manual.

P5210
Active Differential Probe.
Includes: 2 each Large Hook clips; 2 each Small Hook Clips; 2 each Probe Heads; Soft Case; Manual.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

Opt. C3 (P6205 only) – Three years of Calibration Services.

Opt. C5 (P6205 only) – Five years of Calibration Services.

See page 581 for further information.

ACCESSORY PACK (P5200, P5205)
Order 020-2106-00.
Includes: 2 each Plunger Clamps; 2 each Crocodile Clips.

ACCESSORY PACK (P5200, P5205)
Order 020-2140-00.
Includes: 2 each Extender Leads; 2 each Lead Adapters; 2 each Plunger Hook Clips.

ACCESSORY PACK (P5210)
Order 020-2195-00.
Includes: 2 each Large Hook Clips; 2 each Small Hook Clips; 2 each Probe Heads.

SOFT CASE
Order 016-1461-00.

POWER SUPPLY (P5205, P5210 ONLY)
TEKPROBE Power Supply. Order 1103.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Voltage Isolators

A6906S • A6907 • A6909

Features

A6906S

- Fiber Optic Separation up to 200 m
- Single Channel
- GPIB
- Battery Powered Transmitter
- High Performance

A6907

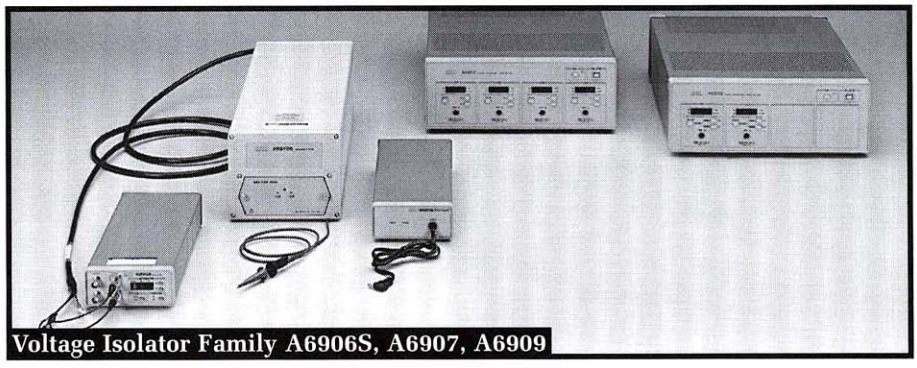
- Monolithic
- 4 Channels
- GPIB
- Mid Range Performance

A6909

- Monolithic
- 2 Channel
- GPIB Optional
- Mid Range Performance

Applications

- Motor Drives
- Power Supplies
- Electronic Ballast
- UPS Systems
- Switch Mode Control
- Power Semiconductors



Voltage Isolator Family A6906S, A6907, A6909

Voltage Isolators

Tektronix offers the most complete line of isolation products to satisfy your high performance floating measurement requirements. The isolation product family includes four isolation instruments which provide a wide range of accurate and safe solutions to your measurement problems.

As discussed in the Floating Measurements overview, we define floating measurements as measurements in which neither reference point is ground. We provide three isolators for making floating measurements – one of which will be the most appropriate to your specific situation. All the isolators are third party safety certified.

MONOLITHIC VOLTAGE ISOLATORS

Monolithic voltage isolators provide multiple channels in a convenient portable package. These units are designed to be used next to the measurement instrument where physical separation is not a requirement. Because multiple channels are contained within a single unit, the cost per channel is lower and the circuit/instrument connections are simplified. Our monolithic four and two channel voltage isolators, the A6907/A6909, are an economical solution for isolation of power devices with switching speeds consistent with their dV/dt and slew rate characteristics.

ISOLATION SYSTEMS

The A6906S Fiber Optic Isolation System not only provides exceptional isolation performance but the flexibility of physical separation as well. This system consists of a specially designed floating probe connected to a battery powered transmitter unit. The transmitter converts the electrical signal to light which is transmitted via a fiber optic cable to the receiver unit. The receiver unit converts the light back to an electrical signal which is input into the measurement instrument via a 50 Ω BNC cable. The fiber optic cable not only provides total isolation, but has the advantages of EMI immunity, light weight and flexibility which has made it the standard for state of the art signal transmission.

ISOLATOR CHARACTERISTICS SUMMARY

		A6907	A6909	A6906S
Bandwidth (–3 dB)		60 MHz	60 MHz	100 MHz
Maximum Voltage		±850 V	±850 V	±850 V
Common to GND Slew Rate		20,000 V/µs	20,000 V/µs	100,000 V/µs
Separation Distance		1.5 m	1.5 m	3 m, 10 m, 20 m, 100 m, 200 m
CMRR*1	@ 60 Hz	105 dB	105 dB	120 dB
	@ 1 MHz	60 dB	60 dB	60 dB
	@ 10 MHz	50 dB	50 dB	40 dB
Channels		4 (Monolithic)	2 (Monolithic)	1
Isolation Method		Optical/transformer	Optical/transformer	Fiber optic
GPIB		IEEE 488.1	Option 10 (488.1)	IEEE 488.1
Recommended Environment		Ambient	Ambient	Ambient
Battery Operating Time		N/A	N/A	12 hours

*1 With Probe.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Isolation Systems

A6907 • A6909

Features

A6907

- For Floating Signals to ±850 V
- 60 MHz
- Monolithic
- 4 Channels
- CMRR: 60dB @ 1 MHz
- GPIB
- Push-button self-calibration of offset and gain
- Each channel can be individually set for coupling and attenuation

A6909

- For Floating Signals to ±850 V
- 60 MHz
- Monolithic
- 2 Channels
- CMRR: 60dB @ 1 MHz
- GPIB Optional
- Push-button self-calibration of offset and gain
- Each channel can be individually set for coupling and attenuation

Applications

- Motor Drives
- Power Supplies
- Electronic Ballast
- UPS Systems
- Switch Mode Control
- Power Semiconductors

A6907/A6909

A6907/A6909 Voltage Isolators

The A6907/A6909 monolithic voltage isolators are essential tools for power conversion design. Accurate floating measurements are required to design and verify high-performance switch mode circuits. The A6907 and A6909 offer safety, performance, multiple isolated channels (A6907-four/A6909-two), direct connection to the measurement instrument and simplified controls in a single box. The A6907/A6909 offer high performance and safety for the lowest cost per channel.

The A6907/A6909 Isolators feature a bandwidth of 60 MHz, slew rate of 20,000 V/µs and CMRR of 60 dB (1,000:1) at 1 MHz and GPIB control (standard on the A6907; available as Option 10 for the A6909) in a package the size of a Tektronix TDS Oscilloscope. The ±850 V probes plug directly into the isolator and are specifically designed for safe connection to floating circuits and enhanced CMRR.

Characteristics

ELECTRICAL

Attenuation Settings – 2,000X to 1X (100 mV/div to 200 V/div with oscilloscope set to 100 mV/div) in 1-2-5 steps.

Full Range Measurements – ±2 mV to ±850 V.

Frequency Response Bandwidth – 60 MHz (–3 dB).

Transient Response – Rise Time:
<7.0 ns 100 mV/div and 200 mV/div.
<5.8 ns 500 mV/div to 200 V/div.

Maximum Working Voltage – 600 V RMS, 850 V (DC + peak AC).

Input Impedance –
Resistance: 10 MΩ.
Capacitance: 4.5 pF, ±0.5 pF.

Output Impedance – 50 Ω.

Output Drive – ±500 mV into 50 Ω load.

Maximum Common to Ground Slew Rate – 20,000 V/µs.

Offset Accuracy – ±20 mV.

Delay – ≈30 ns with 1.5 m probe cable.

CMRR –
60 Hz: >105 dB (100 mV/div), >100 dB (1 V/div).
1 MHz: >60 dB (100 mV/div), >45 dB (1 V/div).
10 MHz: >50 dB (100 mV/div), >40 dB (1 V/div).

POWER REQUIREMENTS

Line Voltage Ranges – 90-250 V AC.

Line Frequency Range – 47-66 Hz.

Maximum Power Consumption – A6907: 48 W. A6909: 28 W.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

A6907
60 MHz Monolithic 4-CH Isolator (850 V Maximum).
Includes: Four 850 V Floating Probes (010-0576-00); 43 in. 50 Ω Cable Set (4); A6907/A6909 User Operator Instruction Manual (070-9094-04).

A6909
60 MHz Monolithic 2-CH Isolator (850 V Maximum).
Includes: Two 850 V Floating Probes (010-0576-00); 43 in. 50 Ω Cable Set (2); A6907/A6909 User Operator Instruction Manual (070-9094-04).

Opt. 10 – Add GPIB.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – United Kingdom 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

See Customer Information Section for additional description.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

Isolation Systems
A6906S

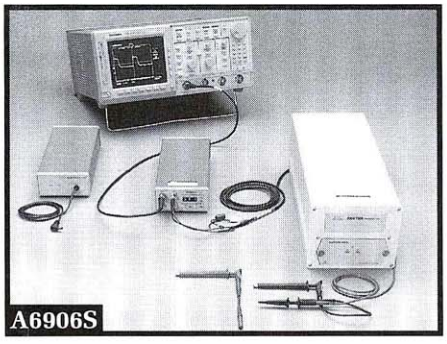
Features

A6906S

- 850 V of Isolation
- DC to 100 MHz
- CMRR: 40 dB @ 10 MHz
- Up to 200m of Probe-to-scope Fiber Optic Separation
- Selectable 20X to 5000X Attenuation
- GPIB Controllable
- 50 Ω and 75 Ω Output

Applications

- Motor Drives
- Power Supplies
- Electronic Ballasts
- UPS Systems
- Switch Mode
- Power Semiconductors



A6906S

The A6906S is the highest performance Isolation System available. This is what you need to make floating measurements on state-of-the-art power control devices such as IGBTs used on fast motor drives and switching power supplies. The bandwidth is 100 MHz and an extraordinary 200 meters of fiber optic cable is available. All system parameters, including attenuation, can be controlled via a General Purpose Interface Bus. System CMRR with the probe is 60 dB (1,000:1) out to 1 MHz and 40 dB (100:1) at 10 MHz. This premium product will exceed your expectations for quality, performance and reliability.

The A6906S consists of a floating probe, battery powered transmitter unit, connecting fiber optic cable, receiver unit, and battery charger.

Order A6906S Fiber Optic Isolation System Data Sheet 51W-9086-0 for more information.

Characteristics

ELECTRICAL

Attenuation Settings – 5,000X to 20X in 1-2-5 steps.

Full Range Measurements – ±25 mV to ±850 V.

Frequency Response Bandwidth – 100 MHz (–3 dB).

Transient Response – Rise Time <3.5 ns.

Maximum Working Voltage – 600 V RMS, 850 V (DC + peak AC).

Input Impedance – Resistance: 10 MΩ ±2%. Capacitance: 2.9 pF.

Output Impedance – 50 Ω and 75 Ω ±5% at DC.

Output Drive – ±1V into 50 Ω load.

Max Common to Ground Slew Rate – 100 kV/µs.

Zero Drift with Temperature – 40 mV (10 to 40°C). 80 mV (0 to 50°C).

Delay – ≈ 50 ns for 3 meter fiber optic cable. Add ≈ 5 ns per meter for longer cables.

Common Mode Rejection Ratio –
60 Hz: >120 dB.
1 MHz: >60 dB.
10 MHz: >40 dB.

POWER REQUIREMENTS

Line Voltage Ranges – 90-250 V AC.

Line Frequency Range – 47-66 Hz.

Maximum Power Consumption – 10 W.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

A6906S
100 MHz Fiber Optic Isolation System (850 V Max). **Includes:** One 850 V Floating Probe (010-0568-00); Industrial Lead Set (012-1392-00); 50 Ω Terminator (011-0049-01); 43 in. 50 Ω Cable (012-0057-01); Optical Fiber Cleaner (016-1218-00);1 Rechargeable Battery Pack (650-3022-00); A6906S User Operator Instruction Manual (070-8900-00).

Opt. 01 – Substitute 20 Meter Fiber Optic Cable.

Opt. 02 – Substitute 100 Meter Fiber Optic Cable.

Opt. 03 – Substitute 200 Meter Fiber Optic Cable.

Opt. 04 – Substitute 10 Meter Fiber Optic Cable.

GPIB Cable – Order 012-0991-00.

75 Ω BNC Cable – Order 012-0074-00.

75 Ω Termination – Order 011-0055-01.

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – UK 240 V, 50 Hz.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

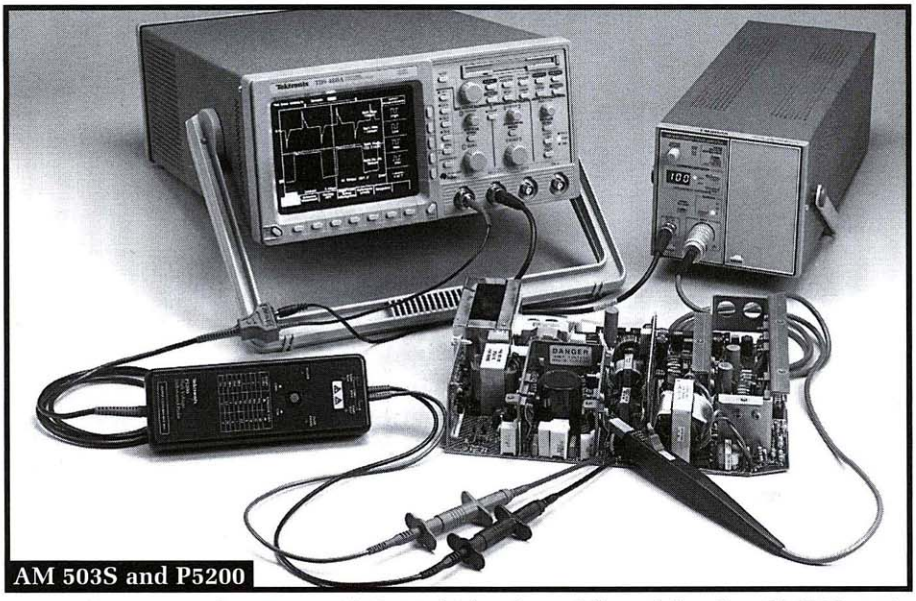
See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Current Measurements



AM 503S current probe system with P5200 high voltage differential probe with TDS 460A.

Current Measurements

Tektronix offers the widest selection of high performance current probes available. Tektronix current measurement systems provide programmable and manual simultaneous AC/DC measurements, bandwidth coverage from DC to 1 GHz and amplitude measurements from mAs to 20,000 A.

Current probes measure the flux field generated by the movement of electrons through a conductor. Within the range specifications of the current probe, the flux field surrounding a conductor is converted to a linear voltage output which can be displayed and analyzed on an oscilloscope or other measurement instrument.

Tektronix provides current probes for AC only and AC/DC current measurements. The AC only probes are available in solid and split core configurations.

CURRENT PROBE SELECTION GUIDE

Type AM 503B or AM 5030 Amplifiers with:	Bandwidth Hz to MHz	Peak Pulse	Max AC p-p	Derate Below	Derate Above	Max DC	Amp*S Product	Current/Div Display Range	Rise Time	Insertion Impedance @ 1 MHz	Max Barewire Voltage	Max Conductor Diameter	Cable Length
A6312	DC to 100	50 A	40 A	N/A	20 kHz	20 A	$100x10^{-6}$	1 mA to 5 A*1	≤3.5 ns	0.1 Ω	300 V	0.15 in.	2 m
A6312 w/ CT-4	0.5 to 20	20 kA*2	2 kA*3	50 Hz	1.2 kHz	20 A	0.1	20 mA to 5 kA*1	≤17.5 ns	30 mΩ	3 kV	1.5 in.	2 m
A6302	DC to 50	50 A	40 A	N/A	20 kHz	20 A	$100x10^{-6}$	1 mA to 5 A*1	≤7.0 ns	0.1 Ω	300 V	0.15 in.	2 m
A6302 w/ CT-4	0.5 to 20	20 kA*2	2 kA*3	50 Hz	1.2 kHz	20 A	0.1	20 mA to 5 kA*1	≤17.5 ns	30 mΩ	3 kV	1.5 in.	2 m
A6302XL	DC to 17	50 A	40 A	N/A	20 kHz	20 A	$100x10^{-6}$	1 mA to 5 A*1	≤20 ns	0.1 Ω	300 V	0.15 in.	8 m
A6302XL w/ CT-4	0.5 to 13	20 kA*2	2 kA*3	50 Hz	1.2 kHz	20 A	0.1	20 mA to 5 kA*1	≤20 ns	30 mΩ	3 kV	1.5 in.	8 m
A6303	DC to 15	500 A	200 A	N/A	20 kHz	100 A	$10,000x10^{-6}$	5 mA to 50 A*1	≤23 ns	0.02 Ω	700 V	0.83 in.	2 m
A6303XL	DC to 10	500 A	200 A	N/A	1.8 kHz	100 A	$10,000x10^{-6}$	5 mA to 50 A*1	≤35 ns	0.02 Ω	700 V	0.83 in.	8 m
A6304XL	DC to 2	700 A	700 A	N/A	1.8 kHz	500 A	0.4	500 mA to 200 A*1	≤175 ns	0.2 Ω	700 V	0.83 in.	8 m

	Bandwidth Hz to MHz	Peak Pulse	Max AC p-p	Derate Below	Derate Above	Max DC	Amp*S Product	Current/Div Display Range	Rise Time	Insertion Impedance @ 1 MHz	Max Barewire Voltage	Max Conductor Diameter	Cable Length
P6021	120 to 60	250 A	15 A	300 Hz	5 MHz	0.5 A	$500x10^{-6}$	20 mA or 100 mA*1	≤5.8 ns	0.03 Ω	600 V	0.15 in.	2.75 m/1.5 m
P6021 w/ CT-4	120 to 20	20 kA*2	2 kA*3	300 Hz	1.2 MHz	20 A	0.5	400 mA or 100 A*1	≤17.5 ns	0.03 Ω	3 kV	1.5 in.	2.75 m/1.5 m
P6022	935 to 120	100 A	6 A	3 kHz	10 MHz	0.2 A	$9x10^{-6}$	10 mA or 100 mA*1	≤2.2 ns	0.03 Ω	600 V	0.10 in.	2.75 m
CT-1	25K to 1000	12 A	1.4 A	–		0.3 A	$1x10^{-6}$	2 mA*1 (5 mV/mA)	≤0.35 ns	1 Ω	1000 V	0.070 in.	1.07 m
CT-2	1.2K to 200	36 A	7 A	–		0.3 A	$50x10^{-6}$	10 mA*1 (1mV/mA)	≤0.5 ns	0.04 Ω	1000 V	0.052 in.	1.07 m
TEKPROBE® (TDS 400/500/600/700 and 11000 Series)													
TCP202	DC to 50	50 A	40 A	N/A	20 kHz	15 A	$500x10^{-6}$	*4	≤7.0 ns	0.07 Ω	300 V	0.15 in.	2.2 m
TCP202 w/ CT-4	0.5 to 20	20 kA*2	2 kA*3	50 Hz	1.2 kHz	15 A	0.1	*4	≤17.5 ns	30 mΩ	3 kV	1.5 in.	2.2 m

**1 Scope set at 10 mV/Div.*

**2 Based on voltage breakdown.*

**3 Based on thermal heating limits in CT-4.*

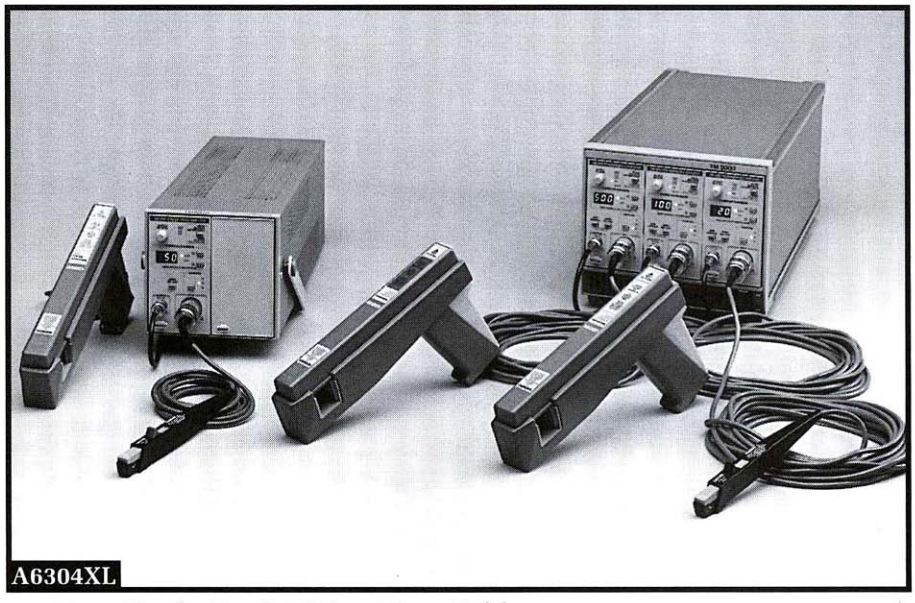
**4 Depends on instrument used.*

Current Measurements

AC AND DC CURRENT MEASUREMENTS

AC currents induce voltage in a transformer resulting from the buildup and collapse of flux fields as the current changes direction. AC current probes are passive in that they do not require external power. A steady state DC current, however, will not induce a current in a transformer. By taking advantage of the Hall Effect, a current biased semiconductor device will produce a voltage output in response to a DC generated flux field. Consequently, a DC current probe is an active device in that it requires external power.

Each type of current sensing device will roll off, or produce a non-linear output at a certain point. A given AC probe will roll off at a certain maximum current amplitude and frequency, as well as at a minimum amplitude and low-end frequency. DC current probes will be linear from DC to a maximum frequency and will have a minimum and maximum sensitivity level as well. Since we often encounter signals which contain both AC and DC components, it is important to be able to measure both simultaneously with a single probe. In addition, signals which may look like AC, such as a square wave switching on and off, but never fall below zero amps, actually have a significant DC component and cannot be accurately captured with a transformer only AC probe. The unique Tektronix solution is to combine both a Hall Effect device and a transformer to provide broadband current measurement capabilities within one system.



500 A A6304XL with AM 503B in TM 502A Power Module.

SPLIT VERSUS SOLID CORE

To accurately measure the flux field, we need to completely surround the conductor with the probe core. Tektronix offers two mechanical probe configurations: split core and solid core. Split core probes offer convenience. Precisely engineered and manufactured, the split core probes can be clipped onto a conductor without having to break the connection.

Solid core current transformers (CT) offer small size and very high frequency response for measuring very fast, low amplitude current pulses and AC signals. They are designed to be permanently or semi-permanently installed and have cables which are easily connected and disconnected to the CT.

In this Current Probe section we will describe the features and characteristics of each of the Tektronix Current Probes, as well as mention some of the primary applications of each.

AMP*SECOND PRODUCT

As mentioned in the current probe introduction, transformer core materials saturate and become nonlinear when they are subjected to too much current. "Too much current" is a function of both the amplitude of the current and the time it is applied. The product of the *average amplitude* times the *pulse width* is called the amp*second product. Each probe has an amp*second product specification (see the Current Probe Selection Guide). If the signal does not exceed this specification, the voltage output will be linear and the measurement accurate.

A special feature of the AM 503S Current Probe Systems utilizes the phenomenon that opposing currents are subtractive. The AM 503S senses the current level in the conductor under test and feeds an equal but opposite current through the probe. This "bucking current" nulls out the current in the transformer and eliminates any core saturation. The bucking current limit is 20 A in the A6312 and A6302XL, 100 A in the A6303XL and 500 A in the A6304XL. Up to these amplitudes you need not be concerned about the amp*second product.

DC Coupled Current Probe

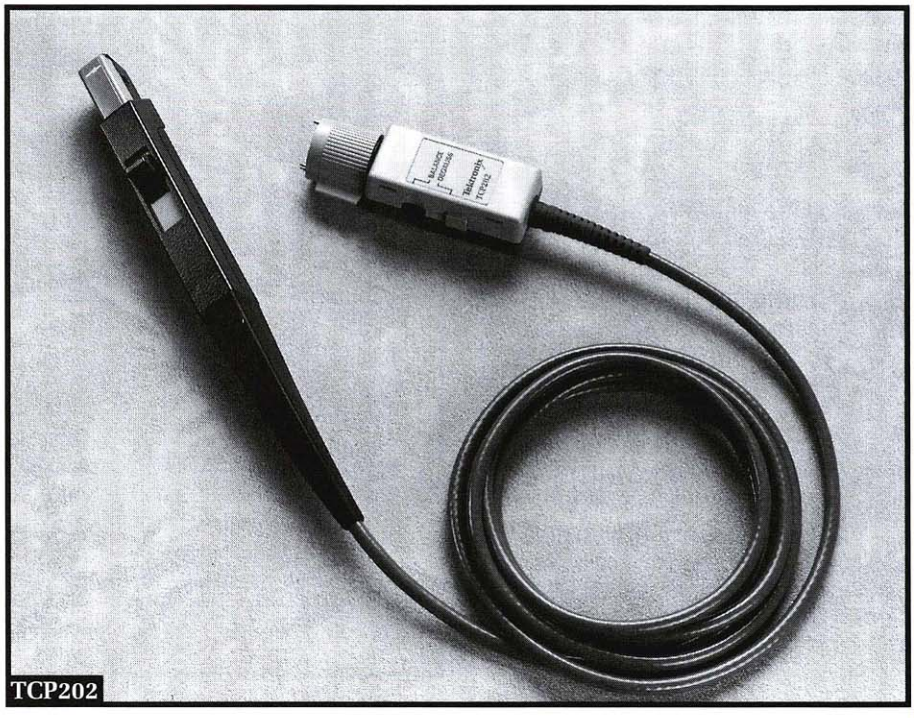
TCP202

Features

- Easy Current Measurements
- Probe Connects Directly to TDS Scope through TEKPROBE® Interface
- Split Core Construction for Easy Circuit Connection
- DC to 50 MHz Bandwidth
- 15 Amps DC + Peak AC Current
- 50 Amps Peak Pulse Current
- 500 x 10^{-6} Amp*Sec Product
- Safety Certified

Applications

- Motor Drives
- Switching Power Supplies
- Disk Drive
- Electronic Ballasts
- Inverters
- Avionics



TCP202 DC Coupled Current Probe

When combined with a Tektronix TDS oscilloscope, the TCP202 enables users to make direct readout DC and AC current measurements, resulting in accurate displayed and recorded measurements.

The TCP202 is a general-purpose probe for displaying and measuring current in electronic circuits. It's ideal for power supply and motor drive design, and for device testing.

Characteristics

Bandwidth – DC to 50 MHz.

Max DC + Peak AC Current – 15 A.

Max Peak Pulse Current – 50 A.

Minimum Sensitivity – 10 mA/div.

DC Accuracy –
±1% (with probe calibrator).
±3% (without probe calibrator).

Max Bare Wire Voltage – 300 V (Cat I).

TYPICAL CHARACTERISTICS

Insertion Impedance –
0.002 Ω at 1 kHz.
0.1 Ω at 5 MHz.

Propagation Delay – 17 ns.

Max Conductor Diameter –
3.8 mm (0.15 in.).

Electrostatic Immunity –
(per IEC 801-2) > 8 kV.

Amp*Sec Product – 500 x 10–6 Amp*Sec.

Rise Time – ≤ 7.0 ns.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

DC Coupled Current Probe

TCP202

PHYSICAL CHARACTERISTICS

Weight – 0.19 kg (0.44 lbs.).

Cable Length – 2.2 m (7.2 ft).

POWER REQUIREMENTS

TCP202 is powered by the TDS oscilloscope via the TEKPROBE® interface.

SAFETY CERTIFICATIONS

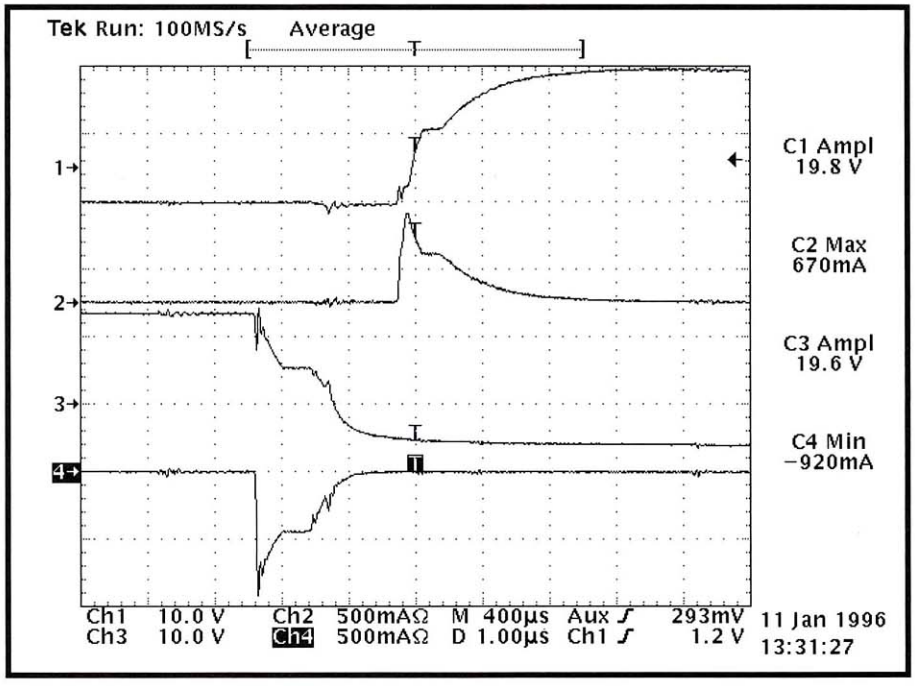
UL 3111-1, CSA 1010.1, IEC 1010-1, 1010-2-032.

RECOMMENDED OSCILLOSCOPES

TDS 520B; TDS 520C; TDS 540B; TDS 540C; TDS 724A; TDS 724C; TDS 734C; TDS 744A (S/N B040100 or higher); TDS 754A; TDS 784A (S/N B040100 or higher); TDS 784C.

TDS 744A and TDS 784A with S/N B030XXX or lower can be upgraded to the latest version using the TDS 7U01 Upgrade Kit.

The TCP202 operates with all other TDS 400, TDS 500, TDS 600, and TDS 700 series oscilloscopes; the scale factor will be correct, but measurement will be indicated as V instead of A.



ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TCP202 DC COUPLED CURRENT PROBE

Includes: Instruction manual (070-9542-00), reference manual (070-9543-00).

RECOMMENDED ACCESSORIES

Probe Calibrator – (015-0672-50)
Use with TDS 510A, TDS 520B, TDS 520C, TDS 540B, TDS 540C, TDS 724A, TDS 724C, TDS 734C, TDS 754A, TDS 784A, and TDS 784C for improved accuracy.

TDS 7U01 Upgrade Kit –
For TDS 744A and TDS 784A.
Please check with your local Tektronix Service Center.

RELATED PRODUCTS

1103 – TEKPROBE Power Supply (for use with non-TEKPROBE BNC scopes).

ADA400A – Differential Preamplifier.

P5205 – High Voltage Differential Probe.

P5210 – High Voltage Differential Probe.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Current Measurement Systems

AM 5030 • AM 5030S • AM 503S • AM 503B

Features

AM 5030/AM 5030S

- GPIB Programmable Current Probe Amplifier
- Plugs into TM 5000 Power Modules
- Operated with External Controller or Manually from Front Panel

AM 503S/AM 503B

- Manual Current Probe Amplifier
- Push Button Auto Balance/Degauss
- Bright LED Current/Division Display
- Eliminates Need to Calibrate Amplifier with Specific Probes
- Plugs into TM 500/5000 Power Modules
- AC/DC Measurements
- With A6302 Probe:
  - DC to 50 MHz
  - 20 A Continuous/50 A Peak
  - Max. Conductor Diameter: 0.15 in.
- With A6303 Probe:
  - DC to 15 MHz
  - 100 A Continuous/500 A Peak
  - Max. Conductor Diameter: 0.83 in.
- With A6304XL Probe:
  - DC to 2 MHz
  - 500 A Continuous/700 A Peak
  - Max. Conductor Diameter: 0.83 in.
- With A6312 Probe:
  - DC to 100 MHz
  - 20 A Continuous/50 A Peak
  - Max. Conductor Diameter: 0.15 in.

Applications

- Switching Power Supplies/Inverters
- Disk Drives
- Electronic Ballasts
- Motor Drives

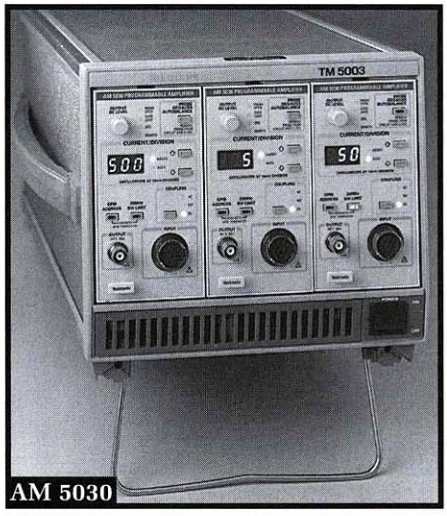
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.



Three AM 5030's in a TM 5003 mainframe. All current measurement parameters can be set using a GPIB controller.

AM 503 Current Measurement Family

The AM 503 Current Measurement system family is the most sophisticated current measurement solution available. The split core probes incorporate both a transformer for AC and a Hall Effect device for DC measurements to provide broadband current measurements from DC to 100 MHz. The AM 5030 Programmable Current Probe Amplifier automates time consuming manual measurements via a GPIB command set. The industry standard AM 503S Current Probe System provides a complete current measurement system in a single package.

The XL Series of probes features eight-meter cables for convenient access to test points. The A6304XL enables measurements of 500 A at DC, 700 A Peak.

For more information about the AM 503 Current Measurement Family, order Data Sheet 51W-7955-2.

AM 5030 PROGRAMMABLE CURRENT PROBE AMPLIFIER

The AM 5030 Current Probe Amplifier with General Purpose Interface Bus (GPIB) adds programmability to the versatile AM 503B. The AM 5030 enables you to use automated techniques to make wide bandwidth AC/DC current measurements. The AM 5030 is a TM 5000 single-wide module that plugs into a 3-slot TM 5003 power module mainframe. While the non-programmable AM 503B will operate in either a TM 500 or TM 5000 power module mainframe, the AM 5030 works only in a TM 5000 mainframe. The AM 5030 uses A6312, A6302, A6303 and the XL Series of current probes and connects to any scope or analyzer via a BNC cable.

Like the AM 503B, the AM 5030 does not have to be calibrated with specific current probes. This is a tremendous operational improvement over the older AM 503. The AM 5030 and AM 503B also provide several improvements over the AM 503A, including a faster Degauss/self-calibration cycle and more responsive, reliable front-panel controls.

The AM 5030 uses the IEEE 488.1 bus standard. Using a simple command set, you can configure and confirm the settings of the amplifier or read the instrument's serial number. You can determine whether the current probe is open or closed, use bus commands to initiate a self-test or force a probe Degauss and DC balance operation. The AM 5030 bus address is set through the front panel and the address is retained when power is removed. The AM 5030 does not require an external controller to operate. It can be completely controlled using the front panel; however, when used with a controller, the front panel can be disabled to prevent manual operator adjustments.

For more information about the AM 5030, request the AM 5030 Programmable Current Probe Amplifier Data Sheet 51W-8941-0.

AM 5030S

The AM 5030S consists of an AM 5030 and a TM 5003. If you already own a power module, order only an AM 5030. If you need a power module, order an AM 5030S. Order the appropriate probes separately.

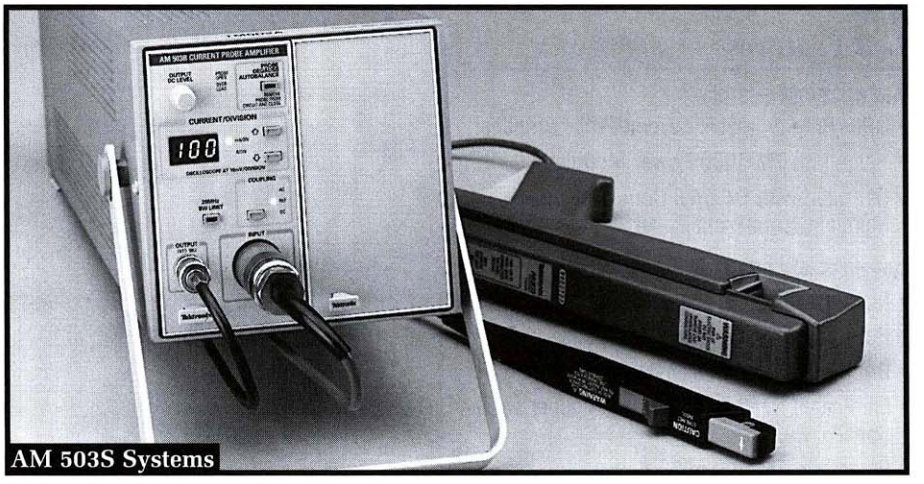
Current Measurement Systems

AM 5030 • AM 5030S • AM 503S • AM 503B

AM 503S CURRENT PROBE SYSTEM

The AM 503S Current Probe System is the most versatile current measurement system available. Since the probes incorporate both a transformer and a Hall Effect device, broadband AC/DC current can be measured simultaneously. Depending on the probe used, current from DC to 100 MHz and up to 700 A can be measured by clipping the split-core probes around the conductor. The AM 503S is truly a system, consisting of an AM 503B Current Probe Amplifier, a TM 502A two-wide Power Module, and an A6302 Current Probe. Options enable you to add or substitute an A6312 Current Probe, A6303 Current Probe or delete the A6302 Current Probe. If you require any of the XL current probes (longer length), then use Option 09 which deletes the A6302.

Order AM 503S Current Measurement System Data Sheet 51W-10226-1 for more information.



AM 503S with A6312 and A6303 probes.

AM 503B CURRENT PROBE AMPLIFIER

The AM 503B Current Probe Amplifier is the heart of the AM 503S System. The AM 503B amplifies and sums the voltage outputs from the transformer and Hall Effect device and outputs it to the measurement instrument. It also provides the Hall Effect Device bias voltage and a reverse "bucking" current which resists saturation of the A6312/A6302/A6303 Current Probe core.

The AM 503B Current Probe Amplifier replaces the AM 503A. All functions are microprocessor controlled, providing a significant improvement in ease of use and functionality. The AM 503B uses bright, easy-to-read LEDs to display current/Division settings which are controlled with up/down push buttons. A single push button provides both Degauss and auto-balance functions. An additional significant improvement with the AM 503B is that individual A6312/A6302/A6303 probes no longer need to be calibrated with a specific amplifier but can be interchanged between AM 503Bs and AM 5030s. The AM 503B and the AM 5030 both support the new XL Series of current probes. The AM 503 and the AM 503A do *not* support the XL Series.The AM 503B operates in any TM 500/TM 5000 power module. The 50 Ω output of the AM 503B can be displayed on any oscilloscope or measurement instrument that has a sensitivity setting of 10 mV/Div. A 50 Ω output cable and termination is included with the AM 503B. The scope or measurement instrument requires at least a 400 MHz bandwidth to display the full bandwidth of the A6312 (100 MHz) and 50 MHz for the A6303. You can select either AC only mode or a DC mode which allows you to display a combined AC/DC current signal.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

AM 5030
Programmable Current Probe Amplifier.
Includes: 50 Ω BNC Cable (012-0057-01); Instruction Manual (070-8766-02); Reference Card (070-8770-01).
The AM 5030 requires an A6312, A6302, A6303 or XL Series Current Probe and a TM 5003 or AM 5030S Power Module Mainframe.

AM 5030S
Programmable Current Probe Amplifier and Power Module.
Includes: AM 5030 Programmable Current Probe Amplifier and TM 5003 3-wide Power Module Mainframe. Order probes separately.

AM 503B
Current Probe Amplifier.
Includes: Same as AM 5030. The AM 503B requires one of the TM 500/5000 Series Power Modules, and an A6312, A6302, A6303 or XL Series Current Probe.

AM 503S
Current Probe System.
Includes: AM 503B Current Probe Amplifier; TM 502A Power Module; A6302 Current Probe; Instruction Manual (070-8766-02).

Opt. 01 – Adds A6303 Current Probe.
Opt. 03 – Substitutes A6303 Current Probe.
Opt. 05 – Substitutes A6312 Current Probe.
Opt. 09 – Deletes A6302 Current Probe.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – UK 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.
See Customer Information Section for additional description.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

AM5030/AM503S
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.

AM503B
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.

See page 581 for further information.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Current Measurement Systems

A6312 • A6302 • A6302XL • A6303 • A6303XL • A6304XL

Features

A6312
- 20 Amps Continuous/50 Amps Peak
- DC to 100 MHz
- 2 Meter Cable
- Up to 0.15 in. Conductor Diameter

A6302
- 20 Amps Continuous/50 Amps Peak
- DC to 50 MHz
- 2 Meter Cable
- Up to 0.15 in. Conductor Diameter

A6303
- 20 Amps Continuous/500 Amps Peak
- DC to 15 MHz
- 2 Meter Cable
- Up to 0.83 in. Conductor Diameter

A6302XL
- 8 Meter Cable
- 20 Amps
- DC to 17 MHz

A6303XL
- 8 Meter Cable
- 100 Amps
- DC to 10 MHz

A6304XL
- 8 Meter Cable
- 500 Amps
- DC to 2 MHz

Applications

- Motor Drives
- Inverters
- Power Supplies
- Satellite Systems
- Transportation Systems
- Avionics

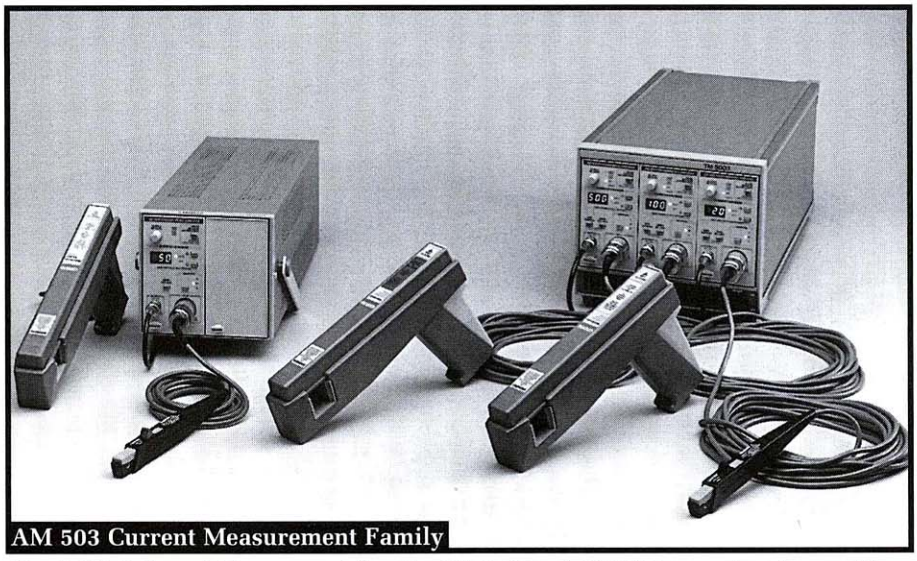
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.



AM 503 Current Measurement Family

The AM 503 Current Measurement Family: AM 503B and AM 5030 current probe amplifiers with A6302, A6303, A6304XL, A6303XL, A6302XL, and A6312 AC/DC-current probes.

AM 503 Family Current Probes

A total of six current probes is available for use with the AM 503B and AM 5030 Current Probe Amplifiers. Since all six probes are of the split-core mechanical design, they easily clip on and off of a conductor. All the probes provide simultaneous DC and AC current measurements with a wide range of current amplitude and bandwidth capabilities.

The AM 503 Current Probes convert the DC and AC flux field of a conductor to a voltage signal which is sent to an AM 503B or AM 5030 Amplifier. The probes include both a Hall Effect device, which senses the DC current, and a ferrite transformer which senses the AC current. The probes also utilize a bucking current from the Amplifier, which eliminates core saturation. The bucking current for the A6302XL is 20 A, 100 A for the A6303XL and 500 A for the A6304XL.

A6312, A6302 and A6303 Current Probes

The A6312, A6302 and A6303 offer a wide range of current measurement capability for the lab and bench environment. The A6312 covers frequencies from DC to 100 MHz while the A6302 covers DC to 50 MHz. Both clip onto conductors up to 3.81 mm (0.15 in.) and measure continuous currents up to 20 A and peak currents up to 50 A as long as they do not exceed the amp*second product of 100 A*µs. The larger A6303 measures higher amplitude, lower frequency currents. It clips onto conductors up to 21.1 mm (0.83 in.) in diameter. Its frequency range is DC to 15 MHz. It will measure continuous currents up to 100 A and peak currents up to 500 A, as long as the Amp*second product of 10,000 A*µs is not exceeded.

The A6312, A6302 and A6303 are also compatible with the 11A16 2-CH Current Probe Amplifier for the 11000 and DSA Series oscilloscopes. With the 11A16, the A6312 and A6302 are rated for 10.5 A, and the A6303 for 52.5 A.

Current Measurement Systems

A6312 • A6302 • A6302XL • A6303 • A6303XL • A6304XL

The eight-meter XL Series Current Probes.

XL Series Current Probes

The three XL current probes add both convenience and expanded current measurement capability. The XL probes are designed to operate with the AM 503B and AM 5030 Current Probe Amplifiers. They are incompatible with the older AM 503 and AM 503A amplifiers. The XL (for extra long) probes have eight-meter cables, which allow you to reach test points on large devices such as heavy duty motors or automobiles. In addition, connecting to test points on transportation platforms such as trains, ships, or aircraft is much easier with the XL probes.

The A6302XL and A6303XL are modified versions of the A6302 and A6303 probes. The A6302XL can measure 20 A continuous (50 A peak) signals from DC to 17 MHz. The A6303XL can measure 100 A continuous (500 A peak) signals from DC to 10 MHz.

The A6304XL is rated for 500 A continuous (700 A peak) and is the same size as the A6303XL. The A6304XL has a bandwidth of DC to 2 MHz and is especially well suited for measurements on high-performance inverters, motor drives, and other high current switch-mode control devices. The eight meter cable makes it very easy to access test points on devices physically separated from your measurement instrument.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

A6312
100 MHz, 2 m, 20 A Current Probe.
Includes: 5 in. (130 mm) Ground Lead (175-0124-01); 3 in. (75 mm) Ground Lead (175-0263-01); 2 Miniature Alligator Clips (344-0046-00): A6302 and A6302/XL Instructions (070-xxxx-xx).

A6302
50 MHz, 2 m, 20 A Current Probe.
Includes: 5 in. (130 mm) Ground Lead (175-0124-01); 3 in. (75 mm) Ground Lead (175-0263-01); 2 Miniature Alligator Clips (344-0046-00): A6302 and A6302/XL Instructions (070-3905-02).

A6303
15 MHz, 2 m, 100 A Current Probe.
Includes: Carrying Case (202-0318-00); A6303 and A6303/XL Instructions (070-3906-02).

A6302/A6303 probes must be used with an AM 503, AM 503A, AM 503B or AM 5030 Current Probe Amplifier.

A6302XL
17 MHz, 8 m, 20 A Current Probe.
Includes: Same as A6302 Current Probe.

A6303XL
10 MHz, 8 m, 100 A Current Probe.
Includes: Same as A6303 Current Probe.

A6304XL
2 MHz, 8 m, 500 A Current Probe.
Includes: Carrying Case (202-0318-00); A6304XL Instructions (070-8939-00).

Note: XL Probes work only with AM 503B or AM 5030 Current Probe Amplifiers.

MEASUREMENT SERVICE OPTION A6303/A6302XL/A6303XL/A6304XL

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

AC Current Probes

CT-1 • CT-2 • CT-4

Features

CT-1

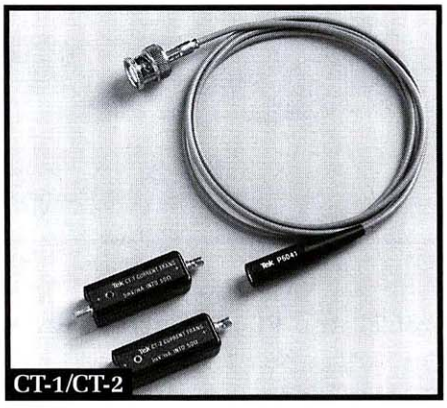
- 25 kHz to 1 GHz
- 12 A Maximum Pulse Current
- 450 mA Maximum CW Current
- For 50 Ω Input
- AC Only
- Solid Core
- ESD Testing
- Disk Drive Read/Write Signals

CT-2

- 1.2 kHz to 200 MHz
- 36 A Maximum Pulse Current
- 2.5 A Maximum CW Current
- For 50 Ω Input
- AC Only
- Solid Core

CT-4

- Pulsed Currents to 20,000 A
- Continuous Currents up to 2000 A p-p
- Accepts 1.5 in. Diameter Conductors
- Measurements on Bare Conductors to 3000 V
- AC
- Split Core
- Use with A6312, A6302, A6302XL, P6021 or TCP202

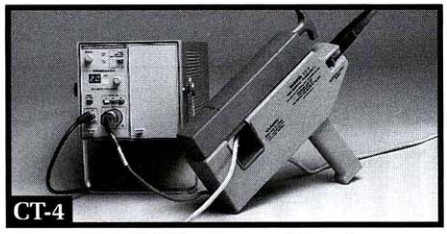


CT-1/CT-2 Current Probes with P6041 BNC Probe Cable.

CT-1/CT-2 Current Probes

The CT-1 and CT-2 Current Probes are designed for permanent or semi-permanent in-circuit installation. Each probe consists of a current transformer and an interconnecting cable. The current transformers have a small hole through which a current carrying conductor is passed during circuit assembly.

The P6041 Probe Cable provides the connection between the CT-1 and CT-2 Current Transformers and a BNC oscilloscope input. A 50 Ω termination is required to terminate the cable when connected to a high impedance (1 MΩ) oscilloscope input. One probe cable can be used to monitor several current transformers that have been wired into a circuit.



AM 503S with CT-4 Current Transformer.

CT-4 Current Probe

The CT-4 is a robust clip-on high current transformer that extends the measurement capability of the P6021, A6302/XL, A6302, A6312 and TCP202 clip-on current probes. Maximum low frequency performance down to 0.5 Hz is obtained using the AM 503S. Current amplitudes to 20,000 A may be measured using the A6302/XL, P6021, A6302, A6312 or TCP202 (with passive termination), provided the amp*second ratings are not exceeded.

The CT-4 may be used with the P6021 for measurements at normal line frequency and above. (The P6022 and A6303 are not compatible with the CT-4.)

The CT-4 has receptacles for current probes in either 20:1 or 1000:1 step-down ratios.

The 1.5 in. square split-core opening makes it possible to clip onto large conductors without breaking the circuit under test. Insulated core and shield assemblies allow measurements on bare wires to 3000 V, and to 14 kV with the included high voltage bushing.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CT-1
Current Probe, Current Transformer and Probe Cable (42 in.).

CT-2
Current Probe, Current Transformer and Probe Cable.
Both Include: Instruction Manual (070-7957-00).
Opt. 09 – Current Transformer only (CT-1/CT-2).
P6041 – Probe Cable (42 in.) only (CT-1 and CT-2).

CT-4
Current Probe, High Current.
Includes: Carrying Case (202-0318-00); 12 in. wide, 4 ft. long High Voltage Bushing (015-0194-00); Instruction Manual (070-6478-01).
DC Bucking Coil – (015-0190-00).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(Except CT4)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

AC Current Probes

P6021 • P6022

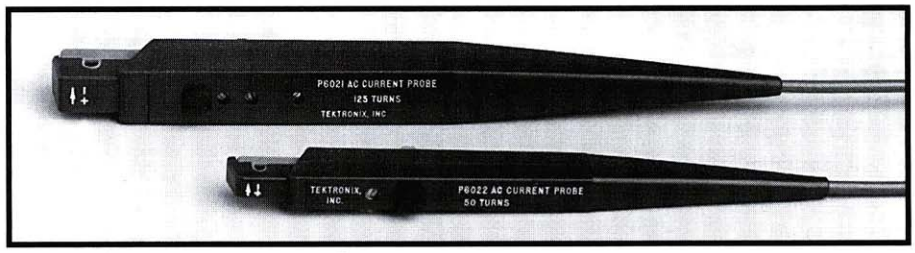
Features

P6021

- 120 Hz to 60 MHz
- 15 A Peak
- For 1 MΩ Inputs
- Shielded Probe Heads
- AC Only
- Split Core

P6022

- 935 Hz to 120 MHz
- 6 A Peak
- For 1 MΩ Inputs
- Shielded Probe Heads
- AC Only
- Split Core



P6021 and P6022 AC Current Probes.

P6021 and P6022 Current Probes

The P6021 and P6022 Current Probes provide versatile AC current measurements. Both probes provide accurate current measurements over a wide range of frequencies. The P6021 and P6022 allow current measurements without breaking the circuit by clipping onto the current carrying conductor. Shielded probe heads are not grounded when the slides are in their open positions, eliminating accidental grounding of the circuit under test.

P6021 Current Probe

For general purpose applications, the P6021 provides wide-band performance with excellent low-frequency characteristics. Bandwidth is 120 Hz to 60 MHz. The passive termination is switchable from 2 mA/mV to 10 mA/mV.

P6022 Current Probe

With a head size of 0.47 in. x 0.25 in. (10 mm x 6 mm, about half the size of the P6021) and a bandwidth of 935 Hz to 120 MHz, the P6022 is ideal for measuring currents in compact, high-performance circuits. Passive termination output is switchable between 1 mA/mV or 10 mA/mV.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(Except P6022)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6021
5 ft. Current Probe with Termination.
Includes: 5 in. (130 mm) Ground Lead (175-0124-01); 3 in. (75 mm) Ground Lead (175-0263-01); Two Miniature Alligator Clips (344-0046-00); Instruction Manual (070-0947-02).

Opt. 03 – 9 ft. with Termination.

P6022
5 ft. Current Probe with Termination.
Includes: Same as the P6021; Instruction Manual (070-0948-01).

Opt. 03 – 9 ft. with Termination.

Passive Termination only –
(P6021) – Order 011-0105-00.
(P6022) – Order 011-0106-00.

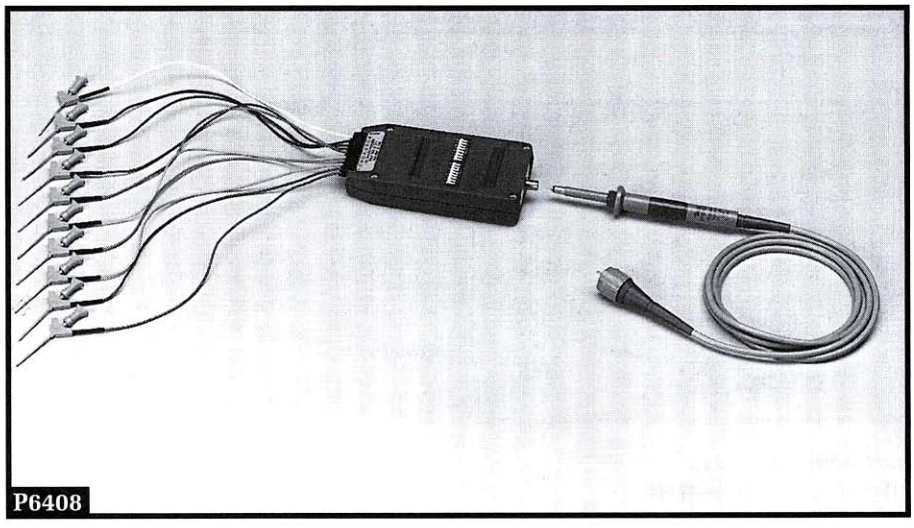
Word Recognizer Trigger Probe

P6408

Features

P6408

- For TTL and TTL-compatible Logic
- 17-Bits (16 Data Bits Plus Qualifier)
- Synchronous and Asynchronous Operation
- Easy to Use
- Simplifies Digital Troubleshooting and Debug
- Use with Any Oscilloscope



P6408

The P6408 is a 16-Bit word recognizer trigger probe for use with analog and digital storage oscilloscopes. It allows the oscilloscope to trigger on user defined logic states (rather than on analog levels), thus extending the utility of the oscilloscope into digital troubleshooting and debug applications.

The P6408 may also be used on oscilloscopes with 15 to 35 pF inputs, when used with the P6109B probe or other probes which have a miniature size probe tip. The P6408 trigger word is manually programmed via miniature DIP switches on the probe pod. The P6408 derives its operating power from the device under test +5 V bus.

Characteristics

Input Channels – Data (Clock/Qualifier)/Power (Ground): 16 (1)/1 (2).

Input Logic Level – HI (ONE)/LO (ZERO): ≥ 2.0 V/≤ 0.7 V.

Input Loading Current – HI (ONE): 20 mA max @ 2.7 V; LO (ZERO): –600 mA max @ 0.5 V.

Maximum Input Voltage Swing – 0 V to ≤ V cc.

Maximum Non-destructive Input Voltage – 1 V (LO) to +15 V (HI).

Word Recognizer Output Level – HI (ONE)/LO (ZERO): ≥ 200 mV/≤ 70 mV.

ASYNCHRONOUS MODE

Maximum Trigger Frequency – 20 MHz.

Minimum Coincidence Between Data Inputs Resulting in a Trigger – 40 ns.

Maximum Coincidence Between any Two Data Inputs Without Producing a Trigger – 40 ns.

Delay of Input Word Coincidence to Word Out – 20 ns.

SYNCHRONOUS MODE

Power Requirements – +5 V ±0.25 V, 100 mA max.

Recommended Instrument – Any instrumentation with 8 to 35 pF inputs.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

P6408
Word Recognizer/Trigger Probe.
Includes: Two (10-wide) Lead Headers (012-0747-01); Pkg. of 20 SMT KlipChip™ Adapters (SMG50); P6109B Probe (complete package); Instruction Sheet (070-6938-00).

ADDITIONAL ACCESSORY

Probe Power Cable – Order 174-1342-00. Used with 1101A Power Supply.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Probe Accessory Packs, Test Leads, Cables

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ACCESSORY PACK/P613X
COMPACT AND SUBMINIATURE
Order 020-1835-01.
Includes: Screwdriver (003-1433-00); Retractable Hook Tip (013-0107-07); Retractable Hook Tip (013-0208-02); 2 in. Ground Lead (195-4240-00); 3 in. Ground Lead (196-3113-03); 6 in. Ground Lead (196-3113-02); 12 in. #6-32 Stud Ground Lead (196-3287-00); 8 in. Ground Lead (196-3286-00); SMT KlipChip™ (206-0364-00); Ground Collar (343-1003-01); Alligator Clip for #6-32 Thread (344-0046-00); 6 in. Ground Lead With 0.025 in. Receptacle (196-3302-00); 6 in. Ground Lead w/Alligator (196-3305-00).

ACCESSORY PACK/MINIATURE PROBE TIPS
(Not shown)
Order 020-1724-00.
Includes: Screwdriver (003-1433-00); Retractable Hook Tip (013-0107-07); Ground Cover (166-0404-01); 6 in. Ground Lead (196-3198-00); 5 in. Ground Lead (175-0124-01); 12 in. Ground Lead (175-0125-01); 3 in. Ground Lead (175-0263-01); SMT KlipChip (206-0364-00); Alligator Clip for #6-32 Thread (344-0046-00); IC Test Tip; 3.5 in. Ground Lead (195-6176-00); Spring Ground (214-4125-00).

ACCESSORY PACK FOR P612X PROBE TIPS
(Not shown)
Order 020-1836-01.
Includes: Screwdriver (003-1433-00); IC Test Tip; Tip Insulator (166-0404-01); 3.5 in. Ground Lead (195-6176-00); 6 in. Ground Lead (196-3302-00); 8 in. Ground Lead (196-3286-00); 12 in. Ground Lead (196-3287-00); Retractable Hook Tip (013-0107-07); Alligator Clip for #6-32 Connector (344-0046-00); SMT KlipChip (206-0364-00); Spring Ground (214-4125-00).

PROBE ACCESSORY BONUS PACKS

020-1386-01	Accessory Kit; Package of 12 (206-0364-00).
020-1708-00	Accessory Pack; Standard Accessories to P6150.
020-1908-00	Accessory Pack; P400 & P850.
020-1993-00	Accessory Kit; SMD Probes.
020-2031-01	Accessory Kit; Miniature Size.
020-2106-00	Accessory Kit with 1 ea. Crocodile Clips, Red and Black.
020-2137-00	Accessory Kit; Leads, Adapters and Marker Strips, for P5102.
020-2140-00	Accessory Pack for P5205. **Includes:** 2 ea 18 in. Extender Leads, Lead Adapters & Plunger Hook Clips.
040-1487-00	Differential Mod Kit for P5100.
131-4244-00	Probe Connector Pack of 100 ea. 131-4209-00 & 136-0962-00.

PROBE TIP GROUNDING HARDWARE

013-0085-00	Probe Tip Ground Collor.
119-4841-00	Adjustable Ground Pin Assembly for Small Probes.
119-4842-00	Ground Pin for Large GE Probe.
131-1302-00	Ground Contact.
166-0557-00	0.381 ID x 0.43 OD x 0.385 Long Ground Cover.
175-1017-00	5 in. Ground Lead.
175-1017-01	5 in. Grounding Strap.
196-3295-00	6 in. Ground Lead with Double Ground Collar.
196-3337-00	12 in. Ground Lead.
344-0046-01	Mini-gator Clip, Steel Jaws.
344-0465-00	Electrical Jaw-grip Clip, 20 mm Wide (open), Black.
344-0466-00	Electrical Jaw-grip Clip. 20 mm Wide (open), Red.
344-0469-00	Crocodile Clip, 4mm x 82 mm Long.

CRT SCREEN IMPLOSION SHIELDS

337-2775-00	CRT Implosion Shield/Filter, Blue.
337-2775-01	CRT Implosion Shield.

PROBES TIPS & ACCESSORIES

131-3685-01	Electrical Contact Spring Tip, Gold Plated.
131-4280-00	Probe Tip Contact.
131-4997-01	2ea. Probe Tip Insulator Assemblies.
206-0153-04	Probe Tip Relay Switch Assembly for P6046.
206-0463-00	Probe Hook Tip for P6015A.
013-0290-00	Probe Hook Tip Set (Large and Small) for P5100.
013-0107-02	Probe Retractable Hook Tip.
134-0016-00	Banana Plug Tip to 10-32 Thread.
013-0107-08	Probe Tip for Miniature/Compact Probes, Black.

PROBE REPLACEMENT HEAD

206-0438-00	Probe Head Assembly with Cable 1.5m Long for P6205.

ADDITIONAL TEST LEADS & CLIPS FOR HANDHELD METERS & OSCILLOSCOPES

012-1392-00	Test Lead Set;(1) Signal, (1) Ground.
012-1447-00	Test Lead Set with 1 ea. Probe Tips and Plunger Tips in Blue, Red, Yellow, Black.
012-1482-00	Test Lead Set with one Red and one Black.
012-0747-01	Test Lead Set 9.8 in. Long for 131-1998-00.

IC TEST CLIPS

013-0242-00	16-Pin IC Test Clip for SOIC.
344-0422-00	PQFP100 Test Clip Assembly.

OTHER ACCESSORIES

062-1675-00	Probe Card; P6062A/P60603A, DP.
067-0563-00	Fixture, CAL; Shield.
067-0681-01	Fixture, CAL; Tunnel Diode Pulser.

Test Leads

ALM01 (Not shown)
UL Listed Red and Black Test Lead Set with Miniature Size Probe Tips. Incorporates Shrouded Banana Plugs and Includes Two Retractable Hook Tips.

Cables

COAXIAL BNC CABLES

50 Ω

012-0057-01	42 in., Male-to-Male.
012-0076-00	18 in., Male-to-Male.
012-0104-00	18 in., Male-to-Female.
012-0208-00	10 in., Male-to-Male.
012-0482-00	36 in., precision (1%) Male-to-Male.
012-1341-00	36 in., Male-to-Male.
012-1342-00	24 in., Male-to-Male.

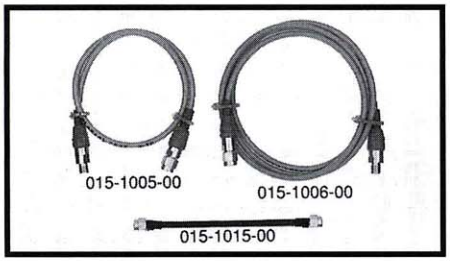
75 Ω

012-0074-00	42 in., Male-to-Male.
012-0074-01	32 in., Male-to-Male.
012-1337-00	60 in., Male-to-Male.
012-1338-00	36 in., Male-to-Male.
012-1339-00	24 in., Male-to-Male.

Probe Accessory Packs, Test Leads, Cables

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.



COAXIAL SMA (3MM) 50 Ω CABLES

General Purpose Flexible Cables

174-1364-00 12 in., Male-to-Male.
174-1427-00 20 in., Male-to-Male.
174-1428-00 60 in., Male-to-Male.
174-0679-00 2 m, SMA Male-to-Male.
174-1120-00 8.5 in., SMA Male-to-Male.
174-1341-00 1 m, SMA Male-to-Male.

Precision, Flexible Delay Cables

015-0560-00 2 ns, Male-to-Male.
015-0561-00 5 ns, Male-to-Male.
015-0562-00 1 ns, Male-to-Male.
015-1005-00 2 ns, Male-to-Female.
015-1006-00 5 ns, Male-to-Female.
015-1019-00 1 ns, Male-to-Female.

Fiber Optic Cable

174-3096-00 50 m, Fiber Optic Cable.
174-2324-00 2 m, Fiber Optic Cable, 62.5 Micron, FC.PC to SMA 906.
174-2323-00 2 m, Fiber Optic Cable, 62.5 Micron, FC/PC to BICONIC.
174-0876-00 2 m, Fiber Optic Cable, 100/140 Micron, SMA to ST CONN.
174-0878-00 2 m, Fiber Optic Cable, 100/140 Micron, SMA to FC CONN.
174-0879-00 2 m, Fiber Optic Cable, 100/140 Micron, SMA to SMA.

Semi-rigid Delay Cables

015-1015-00 500 ps, 4.5, Male-to-Male.
015-1017-00 750 ps, Male-to-Male.

BNC to Banana Plug-jack, 18 in.

012-0090-00 Black.
012-0091-00 Red.

Banana Plug-jack to Banana Plug-jack, 18 in.

012-0031-00 Red.
012-0039-00 Black.

Pin-jack to Pin-jack, 0.08 in. Dia-pin

012-0180-00 Red, 18 in.
012-0182-00 Black, 18 in.

INTERFACE CABLES (Not shown)

GPIB

012-0991-00 2m, double-shielded.
012-0991-01 1m, double-shielded.
012-0991-02 4m, double-shielded.
012-1282-00 0.5 m GPIB.

Centronics

012-1233-00 3 m, 4693 to Terminal.
012-1214-00 8 ft. Male Centronics to PC 25-Pin D.
012-1284-00 9 ft., Male-to-Male.

RS-232C

012-0911-00 10 ft. DB25 male – DB25 Female, straight through.
012-1285-00 9 ft. DB25 male – DB25 Female, Null Modem.
012-1298-00 9 ft. DB25 Male – DB9 Female, Null Modem.
131-4923-00 DB25 Male – DB25 Male gender changer.
174-1453-00 For 222/224.
012-1241-00 RS-232C, 9-Pin Female to 25-Pin Male.
012-1379-00 RS-232C, 9-Pin Female to 9-Pin Male.
012-1380-00 RS-232C, 9-Pin Female to 25-Pin Male.
012-1398-00 9 in. RS-232C to Plotter/Printer.

Telephone Extension Cable

012-1364-00 84 in. RJ45 8-Position to RJ45 8-Position.

Extender Head for use with SA-42, SA-46, SD-42 Optical to Electrical converters

012-1220-00 1m, Sampling Head Extends Cables for 11801B.
012-1221-00 2 m, Sampling Head Extends Cables for 11801B.

Instrument Power Cords

161-0230-01 92 in. Power Cord, 125 V, 6 A, 3-pole.
161-0104-00 98 in. Power Cord, 125 V, 10 A, 3-pole.

VXI CABLE ASSEMBLIES

Cables with 160-Pin D-sub Connector to Unterminated, all 5m, all 300 V, 80°C

VX1630 80 Conductor Cable with E160F Connector to Unterminated. Used with VXI Module VX4330.
VX1664 8 Twisted Pair Shielded Cable with E160F Connector Female to Unterminated. Used with VXI Module VX4380.
VX1665 40 Twisted Pair Shielded Cable with E160F Connector Female to Unterminated. Used with VXI Module VX4380.
VX1666 16 Twisted Pair Shielded Cable with E160F Connector Female to Unterminated. Used with VXI Module VX4380.
VX1667 36 Twisted Pair Shielded Cable with E160F Connector Female to Unterminated. Used with VXI Module VX4380.
VX1660 80 Conductor Cable with E160F Connector Male to Unterminated. Used with VXI Module VX4380.

Cables with 96-Pin D-sub Connector to Unterminated, 5m, 300 V, 80°C

VX1650 96 Conductor Shielded Cable with 96-Pin D-sub Connector Female to Unterminated. Used with VXI Module VX4350.

Cables with 50-Pin D-sub Connector to Unterminated, 5 m.

VX1657P 25 Twisted Pair Shielded Cable with DD-50 Pin D Connector Male to Unterminated. Used with VXI Module VX4801, VX4244, VX4355, VX4357.
VX1663 24 Twisted Pair Shielded Cable with DD-50 Pin D Connector Female to Unterminated. 300 V, 80°C. Used with VXI Module VX4380.
VX1727 16 Twisted Pair Shielded + 2 Ground Wires Cable with DD-50 Connector Female to Unterminated. 300 V, 80°C. Used with VXI Module VX4353.
VX1733 16 Twisted Pair Shielded Cable 5 m L and 2 ea. 10 Conductor Cable 5 m L with DD-50 Pin Connector Female to Unterminated. Used with VXI Module VX4286.
VX1734 16 Twisted Pair Shielded Cable 5 m L and 2 ea. 10 Conductor cable 5 m L with DD-50 Pin Connector Female to Unterminated. Used with VXI Module VX4287.
VX1746 16 Twisted Pair Shielded Cable with DD-50 Pin D-sub Connector Female to Unterminated, EMI Suppression. Used with VXI Module VX4244.

Cables with 10-Pin Round Connectors, 5 m

VX1735 10 Conductor Cable with 10-Pin Round Connector Male, to Unterminated. Used with VXI Module VX4287.

Cables with 44-Pin D-sub Connector to Unterminated, 5m

VX1640S 22 Twisted Pair Shielded Cable with DB-44 Pin (VX1785) Connector Female to Unterminated. Used with VXI Module VX4356.

Cables with 25-Pin D-sub Connector to Unterminated, 5 m.

VX1742P 12.5 Twisted Pair Shielded Cable with 25-Pin D-sub Connector Male to Unterminated. Used with VXI Module VX4801.

Probe Accessory Packs, Test Leads, Cables

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Cables with 9-Pin D-sub Connector to Unterminated, 5 m

VX1732	3 Individually shielded, Twisted Pair Cable with DEM-9 Connector Male to Unterminated, Used with VXI Module VX4730.

Cables with 20-26 AWG Female Contacts for D-Sub Connector on Each and, all 11 in., all 300 V, 80°C

VX1662	18 Twisted Pair Shielded Cable with 20-26 AWG Female Contacts and Poke Contacts on each. Used with VXI Module VX4380.
VX1661	8 Twisted Pair Shielded Cable with 20-26 AWG Female Contacts and Poke Contacts on each. Used with VXI Module VX4380.

SMB Cable Assemblies

VX1729	SMB Snap-on to BNC Male Coax RG188 Cable. Available in 10 ft, 3 ft, 1 ft, 7 in. L.
VX1730	SMB Snap-on to SMB Snap-on RG188 Cable. Available in 10 ft, 3 ft, 1 ft, 7 in. L.
VX1731	SMB Snap-on to BNC Bulk-head Coax RG188 Cable. Available in 10 ft, 3 ft, 1 ft, 7 in. L.

SMA Cable Assembly

VX1760	SMA to BNC Male Coax RG188 Cable, 10 ft. L. used with VXI Module VX4101.

D-sub Connector Kits

VX1630S	Connector Kit, 160-Pin D Plug Female, Connector and Hood, 300 V, to 80° C.
VX1650S	Connector Kit, 96-Pin D Plug Female, Connector and Hood, 300 V, to 80° C.
VX1780P	Connector Kit, 50-Pin D Plug, Male, Connector and Hood.
VX1780S	Connector Kit, 50-Pin D Plug, Female, Connector and Hood.
VX1781P	Connector Kit, 37-Pin D Plug, Male, Connector and Hood.
VX1781S	Connector Kit, 37-Pin D Plug, Female, Connector and Hood.
VX1782P	Connector Kit, 25-Pin D Plug, Male, Connector and Hood.
VX1782S	Connector Kit, 25-Pin D Plug, Female, Connector and Hood.
VX1783P	Connector Kit, 15-Pin D Plug, Male, Connector and Hood.
VX1783S	Connector Kit, 15-Pin D Plug, Female, Connector and Hood.
VX1784P	Connector Kit, 9-Pin D Plug, Male, Connector and Hood.
VX1784S	Connector Kit, 9-Pin D Plug, Female, Connector and Hood.
VX1785P	Connector Kit, 44-Pin D Plug, Male, Connector and Hood.
VX1785S	Connector Kit, 44-Pin D Plug, Female, Connector and Hood.
VX1786P	Connector Kit, 10-Pin Circular Plug, Male, Connector and Back Shelf.
VX1786S	Connector Kit, 10-Pin Circular Plug, Female, Connector and Back Shelf.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

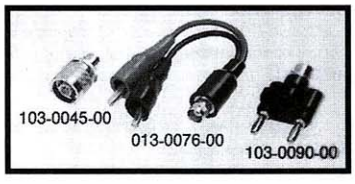
Adapters, Connectors and Adapter Kits

ORDERING INFORMATION

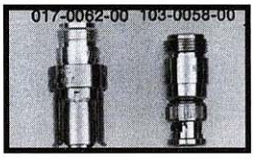
For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

Adapters

017-0064-00	BNC Male to GR
103-0015-00	BNC Male
103-0032-00	BNC Male to UHF Female
103-0033-00	BNC Male to Binding Post
103-0035-00	BNC Male to Dual Binding Post
103-0058-00	BNC Male to N Female
103-0126-00	BNC Male to F type Female



011-0112-00	BNC Male 75 to 50 Ω min. loss
103-0045-00	BNC Female to N Male
103-0090-00	BNC Female to Dual Banana Plug
131-4199-00	BNC Female 75 to 50 Ω Type N Min Loss
103-0076-00	BNC Female to Alligator Clips
103-0261-00	BNC Female to Alligator Clips
103-0076-01	BNC Female to Retractable Hook Tip
131-0112-00	BNC Female 75 to 50 Ω Type N min. Loss
011-0128-00	BNC Insertion TEE



SMA ADAPTERS (Not shown)

015-0369-00	SMA Male to N Male
015-0554-00	SMA Male to BNC Female
015-1009-00	SMA Male to N Female
015-0549-00	SMA Male to SMA Female
020-1693-00	SMA Kit
015-0572-00	SMA Female to BNC Male
015-0553-00	SMA Female to SMA Slide On Male
015-1006-00	SMA Female to GR

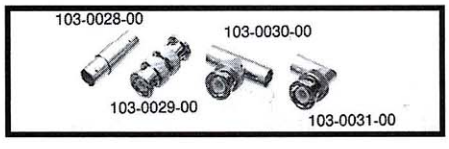
3.5 MM ADAPTERS (Not shown)

015-0552-00	SMA Male to SMA Female
015-0551-00	SMA Male to SMA Male

N STYLE ADAPTERS

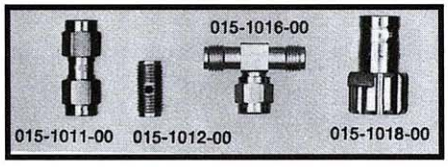
103-0058-00	N Female to BNC Male
105-0509-00	N Male to N Female
103-0045-00	N Male to BNC Female

Connectors



BNC CONNECTORS

103-0028-00	BNC Female to BNC Male
103-0029-00	BNC Male to BNC Male
103-0030-00	BNC "T"
103-0031-00	BNC Elbow Male to Female



SMA CONNECTORS

015-1011-00	SMA Male to SMA Male
015-1016-00	SMA"T"
015-1018-00	SMA Male to BNC Female
015-1012-00	SMA Female to SMA Female
015-1008-00	SMA Female to GR-874
020-1885-00	Fiber Optic Connector Kit w/ FC, ST, DIN, and SC Connectors Specialty Connector Adapters
103-0403-00	RJ45 Phone Jack to 9-Pin D-Sub Female
119-5116-00	ASC-108 Optical connector
017-0063-00	Tek Connector-panel Mount to GR
134-0016-01	Banana-jack to Binding Post 50 Ω Current Loops
015-0672-50	50 Turn Current Loop
015-0601-50	1 Turn Current Loop

MISCELLANEOUS CONNECTORS

013-0126-00	"F" Female to BNC Male.
103-0158-00	"F" Male to BNC Female.

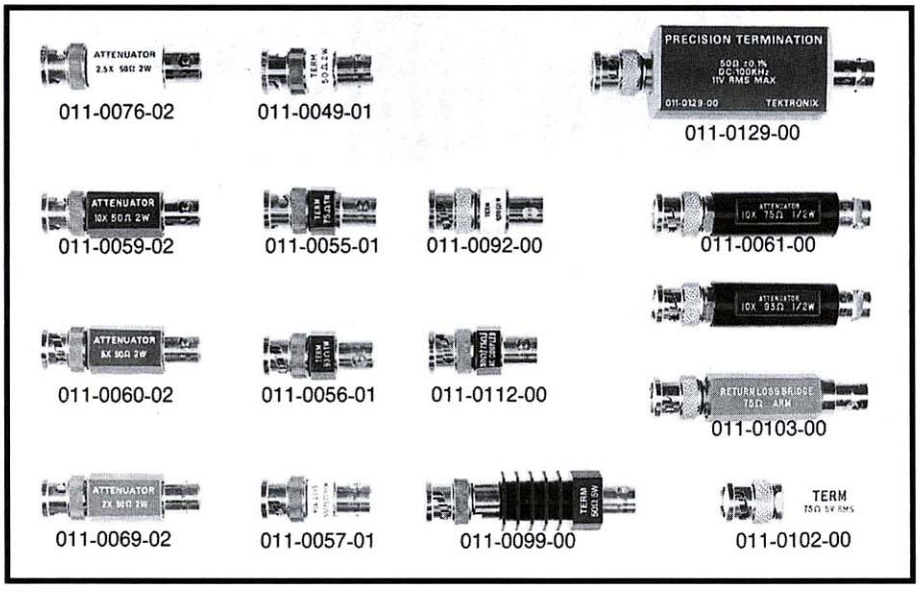
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

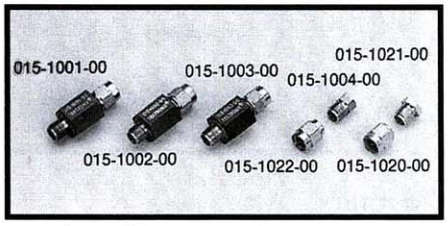
Attenuators/Terminations

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.



BNC (See table next page).



SMA (see table next page).

IMPEDANCE MATCHING TRANSFORMERS

120-1883-00 75 Ω to 50 Ω matching, 50 kHz to 300 MHz.
120-1884-00 75 Ω to 50 Ω matching, 50 MHz to 1 GHz.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

3.5 MM TERMINATIONS (Not shown)

011-0150-00 Female short-circuit.
011-0148-00 Male 50 Ω.
011-0151-00 Male short-circuit.
011-0155-00 Male 50 Ω Precision DC to 26.5 GHz.

ATTENUATORS (Not shown)

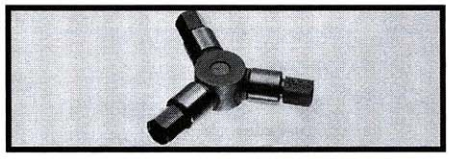
011-0118-00 75 Ω to 50 Ω matching, dBm to dBV.

PROBE TIP ATTENUATORS (Not Shown)

010-0376-00 10X Attenuator P6201
010-0377-00 100X Attenuator P6201
010-0384-00 10X Attenuator P6202A

PROBE TIP TERMINATIONS (Not Shown)

011-0105-00 BNC to P6021
011-0106-00 BNC to P6022



50 Ω POWER DIVIDER

015-0565-00 SMA female connector.
015-1014-00 SMA male connector.
017-0082-00 GR connectors.

Designed for use in broadband 50 Ω systems where the mismatch introduced by ordinary "Tee" connectors is undesirable. Load isolation is nominally 6 dB while the voltage attenuation ratio is nominally 2X (input to either load arm, other load arm terminated in a standard 50 Ω termination). Maximum VSWR on the 015-1014-00 is 1.50 from DC to 12.00 GHz and 1.90 from 12.01 to 18.00 GHz.

Attenuators/Terminations

ATTENUATORS/TERMINATIONS SELECTION GUIDE

BNC 50, 75, and 93 Ω (see photo on previous page)

	Type	Impedance (Ω)	Z-Tol. (Ω)	Atten.	Atten. (dB)	Tol. (dB)	Freq. (DC to) (Watts)	Avg. Power (Watts)	Peak Power	Max. VSWR
011-0049-01	Feed-through termination	50	±1	NA	NA	NA	1 GHz	2	300	1.2 DC to 1 GHz
011-0059-02	Attenuator	50	±1	10X	20	±0.4 to 1 GHz ±0.6 1-2 GHz	2 GHz	2	500	1.1 DC to 1 GHz 1.2-1 to 2 GHz
011-0060-02	Attenuator	50	±1	5X	14	±0.4 to 1 GHz ±0.6 1-2 GHz	2 GHz	2	500	1.1 DC to 1 GHz 1.2-1 to 2 GHz
011-0069-02	Attenuator	50	±1	2X	6	±0.3 to 1 GHz ±0.5 1-2 GHz	2 GHz	2	500	1.1 DC to 1 GHz 1.2-1 to 2 GHz
011-0076-02	Attenuator	50	±1	2.5X	8	±0.3 to 1 GHz ±0.5 1-2 GHz	2 GHz	2	500	1.1 DC to 1 GHz 1.2-1 to 2 GHz
011-0099-00	Feed-through termination	50	±0.5	NA	NA	NA	200 MHz	5	–	1.1 DC to 100 MHz 1.2-100 to 200 MHz
011-0055-01	Feed-through termination	75	±1	NA	NA	NA	100 MHz	1	300	1.1 DC to 100 MHz
011-0056-01	Feed-through termination	93	±1	NA	NA	NA	100 MHz	1	300	1.1 DC to 100 MHz
011-0057-01	Min. loss attenuator	50 to 75	–	2.3X	7.2	±0.5	100 MHz	0.5	–	1.1 DC to 100 MHz
011-0092-00	Feed-through termination	600	±6	NA	NA	NA	1 MHz	1	–	–
011-0100-00	Coax termination	75	–	–	–	–	–	–	–	–
011-0112-00	Min. loss attenuator	75 to 50	–	–	–	–	–	2	–	(AC coupled)
011-0129-00	Feed-through termination	50	±0.05	NA	NA	NA	100 kHz	–	–	–
011-0102-01	Coax termination	75	±0.5	NA	NA	NA	–	0.5	–	–
011-0103-00*[1]	Return loss bridge	75	±0.5	NA	NA	NA	–	–	–	–
011-0118-00	Matching dBm to dBV	50 to 75	–	–	–	–	–	–	–	–
011-0155-00	Coax termination	50	±2%	0.5	1.09	DC to 26.5 GHz	–	–	–	–

*[1] *011-0103-00 red color body; 011-0103-01 green color body; 011-0103-02 white color body.*

SMA (3mm) 50 Ω (see photo on previous page)

	Type	Impedance (Ω)	Z-Tol. (Ω)	Atten.	Atten. (dB)	Tol. (dB)	Freq. (DC to) (Watts)	Avg. Power (Watts)	Peak Power	Max. VSWR
015-1001-00	Attenuator	50	±1.0	2X	6	±0.3	18 GHz	1	500	1.15 DC to 4 GHz 1.25-4 to 12.4 GHz 1.35-12.4 to 18 GHz
015-1002-00	Attenuator	50	±10	5X	14	±0.5	18 GHz	1	500	1.15 DC to 4 GHz 1.20-4 to 8 GHz 1.25-8 to 12.4 GHz 1.35-12.4 to 18 GHz
015-1003-00	Attenuator	50	±1.0	10X	20	±0.5	18 GHz	2	500	1.15 DC to 4 GHz 1.20-4 to 8 GHz 1.25-8 to 12.4 GHz 1.35-12.4 to 18 GHz
015-1004-00	Termination (female)	50	±0.5	NA	NA	NA	18 GHz	0.5	200	1.05 DC to 4 GHz 1.10-4 to 12.4 GHz 1.15-12.4 to 18 GHz
015-1020-00	Short-circuit termination (male)	0	–	NA	NA	NA	18 GHz	NA	NA	–
015-1021-00	Short-circuit termination (female)	0	–	NA	NA	NA	18 GHz	NA	NA	–
015-1022-00	Termination (male)	50	±0.5	NA	NA	NA	18 GHz	0.5	100	–

Printer
HC411

Features

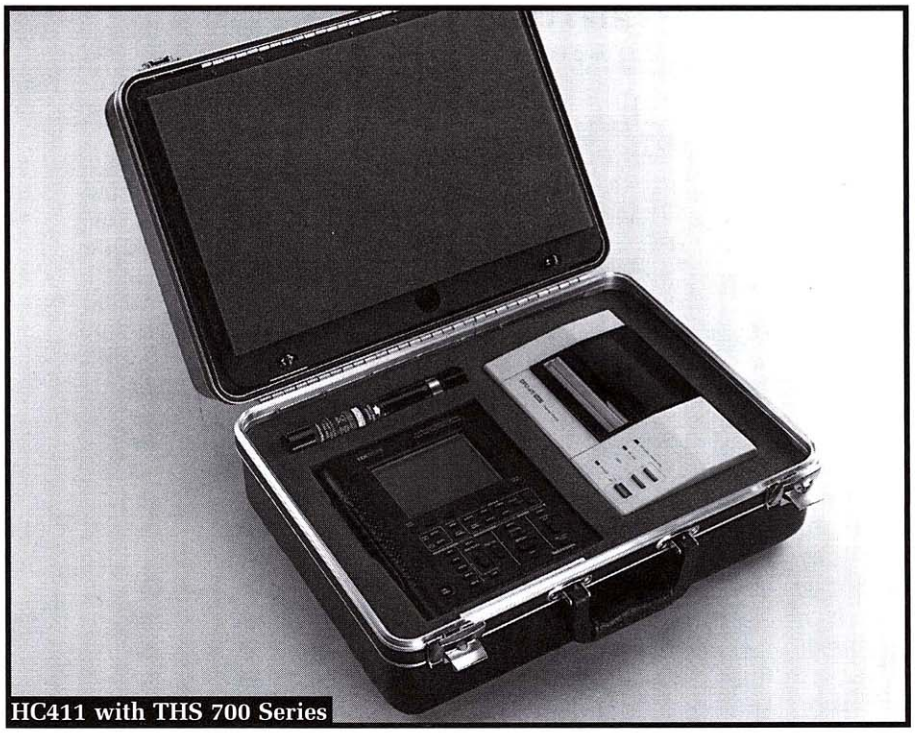
PRODUCT COMPATIBILITY

HC411

- Compatible with THS 700 Series, TV110, TS100, TFS3031, CTS 710, and CTS 750
- Quiet Thermal Printer
- Built-in NiCd Battery
- AC Adapter and Charger
- RS-232C Serial and Centronics Parallel Interfaces
- Lightweight
- Enclosed Paper Supply
- Designed for Portability

Applications

- Business Reports
- Presentations
- Archives
- Documentation



HC411 with THS 700 Series

HC411

The Tektronix HC411 is a thermal printer that features quiet and clear printing in a portable, lightweight, battery-powered package. It can be connected to instruments through either the RS-232C serial or the Centronics parallel built-in interface. The printer's 90 ft. (27 meter) roll of paper provides more than enough records for most applications. The printer can be used with either the AC adapter or the built-in NiCd battery, which can be recharged fully overnight and which can print 1500 lines on a single charge. This printer, which is manufactured by Seiko, is an ideal accessory to several of Tektronix' portable field instruments. It gives the user the capability of making a waveform record in the field and the confidence that the record is correct for the field report.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Printer
HC411

HC411 Characteristics

HC411

Character Set – 256 characters.

Character Font – 9 x 7 dot matrix.

Character Size – 0.074" W x 0.097" H; 1.88 mm W x 2.47 mm H.

Number of Columns – 40 (regular); 80 (condensed).

Line Space – 6 dots programmable.

Printing Speed – 37.5 cps (regular); 50 cps (condensed).

Graphics Mode

Dot Composition – 320 dots/line (regular); 640 dots/line (condensed).

Interfaces – Serial: RS-232C; Parallel: Centronics.

Weight – 2.1 lbs.(0.95 kg) without paper or adapter.

ADAPTER POWER REQUIREMENTS

Line Voltage – 120 V AC or 220 V AC (Opt. A1).

Line Frequency – 60 Hz or 50 Hz (Opt. A1).

Power Consumption – 9 W.

PHYSICAL CHARACTERISTICS

Outside Dimensions	in.	mm
Width	9.45	240
Height	2.3	58.5
Depth	6.38	162
Weight	**lbs.**	**g**
Net	2.1	950

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

HC411
Thermal Printer.
Includes: 1 Roll of Thermal Paper, Operations Manual, AC Adapter.

Opt. 03 – Interface Cable for TFS3031.

Opt. 04 – Interface Cable for CTS 710, CTS 750.

INTERNATIONAL POWER OPTION

Opt. A1 – Universal Euro 220 V, 50 Hz.

ADDITIONAL ACCESSORIES FOR HC411

5 Rolls of Thermal Paper – Order 006-7580-00.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Instrument Carts/Workstations

CONTENTS

TDS SERIES OSCILLOSCOPES

K420 Bench-Height Cart.....525
K465 Storage Tower.....525
K415 Transport Cart.....526
K475 Workstation Tower.....526
K212 Portable Instrument Cart.....527
Test Station (016-1239-00).....527

Instrument Carts/Workstations

Tektronix can free up your valuable work space, make sharing and moving equipment easy, and get you closer to the device under test.

Our ergonomically designed instrument carts and workstations bring a higher level of functionality to the end user, while safeguarding your instrument investment.

All new instrument carts and workstations can be customized to meet your specific requirements. The carts are shipped ready to assemble, allowing maximum configuration flexibility. The shelf height of the carts can be quickly and easily adjusted.

INSTRUMENT COMPATIBILITY CHART

	K212	K415	K420	K465	K475	TEST STATION (016-1239-00)
Oscilloscopes/Digitizers						
11000 Series CSA 803A 404		•		√	•	
DSA 600 Series					√	•
2200/2400 Series	√	•	•			
305/314/336	√	•				
5000/7000 Cabinet			√			
5000/7000 Rackmount		•	√	•	•	
TDS 300/400 Series	√		•	•		
TDS 500,600,700,800 Series		•	√	•	•	
TAS Series	√	•				
2500/2600		•	√	•		
TLS 216		•	√	•		
Television/Spectrum Analyzers						
1480 Series Cabinet	√		•			
1480 Rackmount		√	•		•	
17XX Cabinet	√					
17XX Rackmount		•		•		
1910		√	•		•	
2710 Series	√					
2750 Series		•		•	•	
2780/2790 Series	√		•			
490 Series	√	•				
Logic Analyzers						
1230		•	√	•		
DAS® 9200		•		•	√	•
LV500				•	√	•
Prism 3000		•	•	•	√	•
TLA500/700*1		•	•			
DAS® NT		•	√			
DAS® XP		•	√			
Curve Tracers						
370A/371, 372					√	•
577		•				

√ – *Recommended*
• – *Compatible*

*1 *LACART is the K420 Cart equipped with a mouse pad and skyhook.*

Instrument Carts/Workstations

K465 • K420

Features

K465

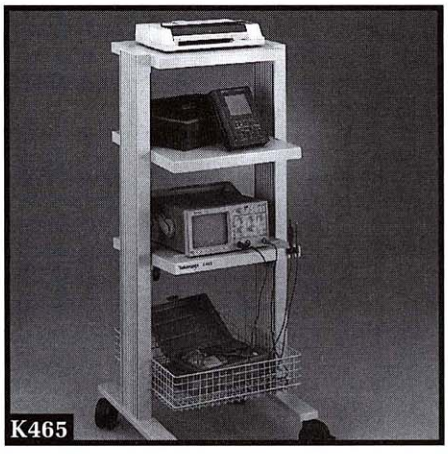
- Three Rack-width Shelves
- Designed for Use with 11K Series and CSA Series Oscilloscopes
- Tiltable Shelf with Positive Locking
- Three-quarter Shelf for Printer
- Tough Steel and Aluminum Construction Means a Secure Platform for All Your Instruments
- Shipped Ready to Assemble to Give Maximum Configurability

K420

- Stable/Mobile Platform
- Tiltable Shelf for Optimum Viewing
- Work-bench Height
- Heavy-duty Nylon Instrument Straps
- Surge and Noise Suppression
- Surge-protected Four Outlet Power Strip Accessory
- Shipped Ready to Assemble

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com



Rack-width Portability

The K465 Instrument Tower is specifically designed for Tektronix' larger oscilloscopes like the 11K Series and the CSA Series. These sturdy carts provide stable and safe instrument mobility with large smooth-rolling four-inch dual durometer twin wheel casters. The tiltable shelf has infinite positive locking positions between horizontal and 26 degrees. The three-quarter shelf is intended to hold a printer or other small device.

Characteristics (K465)

Shelf Tilt – 0° to 26°.

Shelf Loading – Top Shelf: 35 lb. (16 kg). Middle Shelves: 82 lb. (37 kg). Basket: 50 lb. (23 kg).

Durable Work Bench

These sturdy, portable carts are specifically designed for the Tektronix TDS Series Oscilloscopes used in digital design, telecommunications service and installation, and manufacturing environments. The tiltable shelf is rack-width to accommodate your instruments. The cart handle can serve double duty as a probe drape.

In addition, the spacious accessory drawer provides convenient storage for power cords, probes, manuals, and small parts.

Characteristics (K420)

Shelf Tilt – 0° to 26°.

Shelf Loading – 82 lb. (37 kg) per shelf.

Drawer Dimensions – 18 in. x 19.5 in. x 4 in. (645 x 495 x 102 mm).

PHYSICAL CHARACTERISTICS

		K465			K420	
Dimensions		**mm**	**in.**		**mm**	**in.**
Width	Overall Cart	635	25		635	25
	Tilt Shelf	502	19.75	Top Shelf	502	19.75
	All Other Shelves and Basket	508	20	Bottom Shelf	508	20
Height	Overall Cart	1415	55.7		780	30.7
Depth	Overall Cart	533.4	21		620	24.4
	Top Shelf	419	16.5		533	21
	Middle and Bottom Shelves	533.4	21	Bottom Shelf	533	21
Weight		**kg**	**lb.**		**kg**	**lb.**
Net		35	78		26	57

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

K420
Work Bench Cart.
Includes: Probe Holders, Two Heavy Duty Nylon Instrument Straps, Instrument Manual, Retainer Bar, Hex Wrench, Level.

K465
Instrument Tower.
Includes: Two Probe Holders, Four Nylon Instrument Straps, Instrument Manual, Level, Hex Wrench, Retainer Bar.

RECOMMENDED ACCESSORIES

U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01.

Skyhook – Order 384-1800-00.

Mouse Pad – Order 436-0317-00.

Instrument Carts/Workstations

K415 • K475

Features

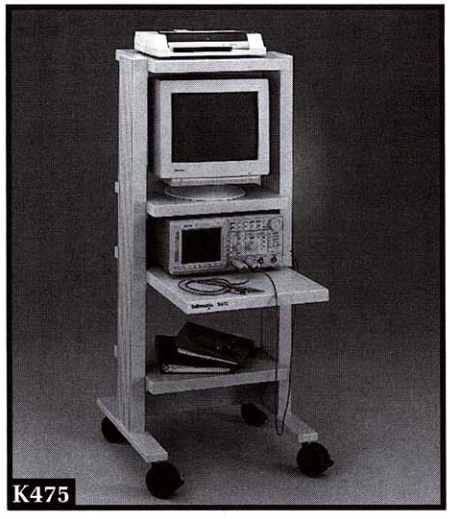
K415

- Constructed of Extruded Aircraft Aluminum
- Tactile Fit and Hold Soft Form Handle
- Stable/Sturdy Platform
- Easy Assembly
- Height Adjustable Shelves

K475

- Rugged Workstation Tower Offering Sturdy, Mobile Instrument Platform
- Oversized Shelf for Larger Oscilloscopes or Fixed Keyboard Platform
- 4 Instrument Restraining Straps
- Steel and Aluminum Design Ensures Solid Support
- Shipped Ready to Assemble to Give Maximum Configurability

K415


K475

Unmatched Value in Portability

The K415 Transport Cart, one of two mid-height carts, is constructed of nearly indestructible high-strength aluminum. These sturdy carts are ideal general purpose utility carts for holding Tektronix portable oscilloscopes, 1230 Logic Analyzers, and other general purpose service instrumentation like the Tektronix TM 5000 and 7000 Series. The K415 consists of two rack-width shelves, plus a wire basket for storage.

Portability For Larger Oscilloscopes

The rugged K475 Workstation Tower is designed for rackmount applications required in digital design, research and development and manufacturing environments. This cart holds Tektronix' larger oscilloscopes, like the DSA Series, providing stable transportation. It includes an extra long shelf (26.6 inches) with ample work space in front of the scope and three three-quarter shelves with loading capacity of 75 lb. per shelf.

PHYSICAL CHARACTERISTICS

		K415			K475	
Dimensions		**mm**	**in.**		**mm**	**in.**
Width	Overall Cart	635	25		635	25
	Top Shelf	508	20	All Shelves	508	20
	Bottom Shelf	508	20			
Height	Overall Cart	907	35.7		1418	55.7
Depth	Overall Cart	533	21		676	26.6
	Shelves	533	21	Middle Shelf	676	26.6
				All Other Shelves	370	16.5
Weight		**kg**	**lb.**		**kg**	**lb.**
Net		30	65		38	83

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

K415
Transport Cart.
Includes: Two Probe Holders, Two Heavy Duty Nylon Safety Straps, Hex Wrench, Instruction Manual, Level.

K475
Workstation Tower.
Includes: Two Probe Holders, Four Nylon Instrument Straps, Hex Wrench, Level, Instrument Manual.

RECOMMENDED ACCESSORIES

U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01.

Skyhook – Order 384-1800-00.

Mouse Pad – Order 436-0317-00.

Instrument Carts/Workstations

TEST STATION • K212

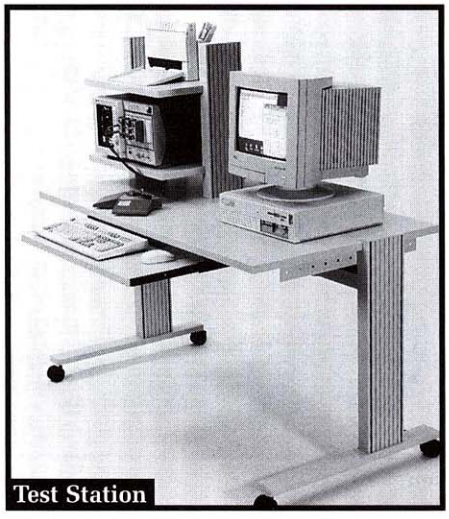
Features

TEST STATION (016-1239-00)

- Organizes System Hardware
- Provides Additional Work Area
- Slide Out Keyboard
- Height Adjustability
- Practical and Sturdy
- Shipped Ready to Assemble

K212

- For All Portable Instruments
- Sturdy and Mobile Platform
- Enhances Sharing and Work Space
- Tiltable Top Tray
- Locking Front Casters
- Four Outlet Power Strip Option



Test Station

K212 Opt. 22

System Mobility and Work Space Functionality

The Test Station is inspired by the Tektronix IPA 310 Interconnect Parameter Analyzer System. It is perfect for use with systems requiring multiple pieces of equipment. It can be used as a standalone work space with enough room for a scope and accessories, as well as an additional work area. The Test Station consists of the main desk top, two shelves, a slide out keyboard, manual holders and power cord channel. Both the shelves and base are height adjustable.

Characteristics

Shelf Loading – 75 lb. per shelf; 100 lb. on main desktop.

Low Cost Portability

The K212 column and trays are made from high strength aluminum; the base is thermo-set polyester.

PHYSICAL CHARACTERISTICS

		Test Station (016-1239-00)		K212	
Dimensions		**mm**	**in.**	**mm**	**in.**
Width	Overall Cart	1442	56	435	17.0
	Shelf	559	22	407	16.0
Height	Overall Cart	1295	51	840	33.0
Depth	Overall Cart	762	30	550	21.6
	Shelf	533	21	352	14.0
Weight		**kg**	**lb.**	**kg**	**lb.**
Net		*1	*1	9	20

*1 *Contact your local Tektronix representative.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TEST STATION
Order 016-1239-00.
Includes: Slide Out Keyboard Tray, Cable Management Channel, Manual Holders.

K212
Portable Instrument Cart.
Includes: Two 1 in. x 5 ft. Securing Straps, Retaining Bar, Instruction Sheet, and Probe Holders.
Opt. 10 – Add Four Outlet Power Strip.
Opt. 12 – Add Second Tray.
Opt. 22 – Combines Opt. 10/12.

RECOMMENDED ACCESSORIES
U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression.
Order 131-5342-01.
Skyhook – Order 384-1800-00.
Mouse Pad – Order 436-0317-00.

Additional Accessories

Features

PORTABLE INSTRUMENT TRANSIT/CARRYING CASES

- High Strength
- Foam Padding
- Custom Fit

PORTABLE INSTRUMENT PROTECTIVE COVERS

- Custom Fit
- Waterproof Vinyl for Complete Enclosure of High-impact Plastic for Front Panel Enclosure

FRONT COVERS

- Snap-on Front Cover
- High-impact Plastic

POWER SUPPLIES

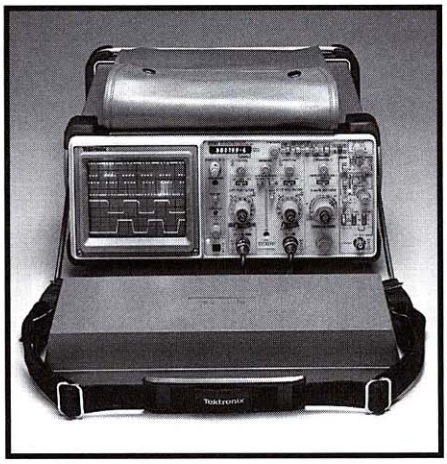
- Wall Mount Power Supply

RECHARGEABLE BATTERY PACK

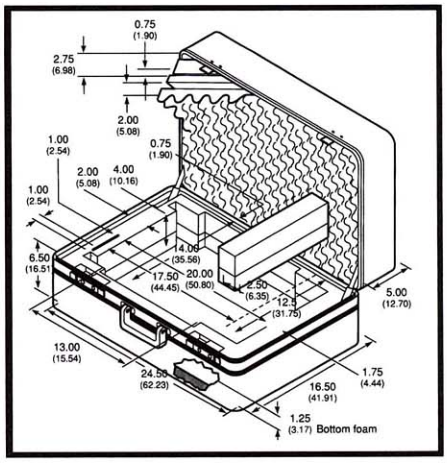
- Battery Packs
- Cigarette Lighter Plug-ins

INSTRUMENT FOOT SWITCH

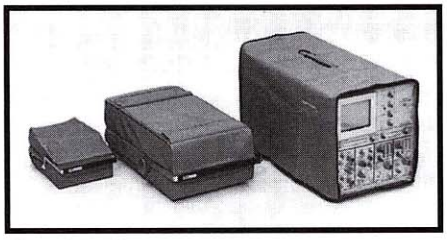
- Foot Operated Start, Switch Measurement



Portable Oscilloscope



016-0792-01 (Shown)



Complete Covers

Front Covers Only

Portable Instrument Transit/Carrying Cases

Rugged transit cases molded of high strength glass-epoxy protect your instruments from hostile environments, shock, vibration, moisture, and impact. Recommended for shipping or transporting your instruments.

Adjustments can be made to the internal padding of the 016-0792-01 to accommodate a wide variety of portable instruments and accessories.

Portable Instrument Protective Covers

The covers provide protection for the instrument during transport or storage. Made of waterproof vinyl, the covers are available for both laboratory and portable instruments. The covers for 5000/7000 Series have clear vinyl frontal areas.

Front Covers

Front covers are available for most portable oscilloscopes, spectrum analyzers, and TM 500/5000 mainframes.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Additional Accessories

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

PORTABLE INSTRUMENT TRANSIT/CARRYING CASES

Hard Sided Case –
271X Family. Order 016-0792-02.
2400 Series, 2200 Series.
Order 016-0792-01.
278X, 279X Family, OF150, OF235.
Order 016-0658-00.
TM 504. Order 016-0608-00.
TM 515. Order 016-0643-00.

Soft Sided Case –
271X Family. Order 016-1158-01.
278X, 279X Family, OF150, OF235.
Order 016-0659-00.

Carrying Strap – 2200/2300 Series, 271X Family. Order 346-0199-00.

Accessory Pouch – 271X Family. Order 016-0677-02.

PORTABLE INSTRUMENT PROTECTIVE COVERS

7300/7400/7600 Series.
Order 016-0192-01.

5000 Series. Order 016-0544-00.

434/464/466. Order 016-0365-00.

TM 504. Order 016-0621-00.

TM 503. Order 016-0620-00.

FRONT COVERS

2400 Series. Order 200-3199-01.

2245A, 2246A, 2247A.
Order 200-3232-01.

2235A, 2236A/271X Family.
Order 200-2520-00.

2201, 2205, 2211, 2225.
Order 200-3397-00.

TM 506. Order 200-1728-00.

TM 504. Order 200-1727-00.

TM 503A. Order 200-3554-00.

1700 Series. Order 200-3897-01.

POWER SUPPLY

Rechargeable Battery Pack – 2 x 4 V, 224. Order 146-0075-00.

Wall Mount Power Supply – 120 V AC, 224. Order 120-1807-00.

Cigarette Lighter Plug Power Cable Adapter – 224. Order 174-1734-00.

Battery Pack, 6 V, 12 A, Lead-Acid Battery – A6906S. Order 650-3022-00.

Probe Power Supply with Amplifier – P6046. Order 015-0106-00.

Wall Mount Power Supply, 120 V AC in, 12 V 100 mA-1.2 W out – J7, J8. Order 119-5032-00.

Power Supply – 1.2 W; 12 V 100 mA, unregulated, 120 V AC 60 Hz, 183 cm CABL. Order 119-4488-00.

Alkaline Battery – 9.0 V, 500 mAH at 510 Ω to 4.8 V, 1604 Case. Order 146-0017-00.

Storage Battery – 6 V, 0.75 AH, with 3 A fuse. Order 146-0033-02.

Power Supply Amplifier – Order 015-0114-00.

Wall Mount Power Supply – 110 V AC-50/60 Hz, to 9.5 V DC-1.5 A. Order 119-1847-02.

Wall Mount Power Supply – 115 V AC, to 9 V DC-1A. Order 119-4242-00.

Power Supply – 12.0 V AC-60 Hz, 1.0 A, 12 W. Order 119-4812-00.

Cigarette Lighter Plug Power Cable Adapter – 32 V, 3 A. Order 198-5810-00.

ACCESSORIES

Instrument Foot Switch – SPDT, 7 A, 125 V AC with micro phone plug. Order 260-1189-02.

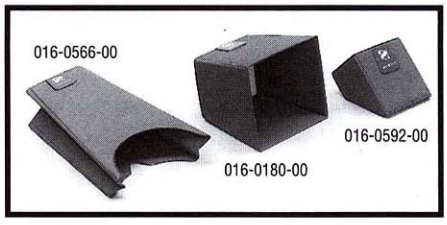
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

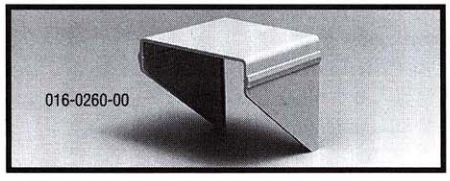
Additional Accessories

Features

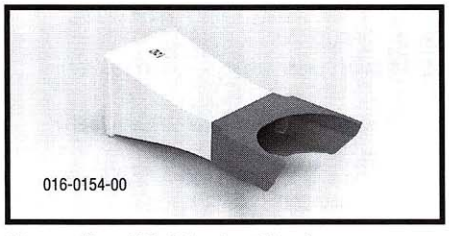
- Viewing Hoods
- Blank Plug-in Chassis
- Blank Panel
- Plug-in Storage Compartment



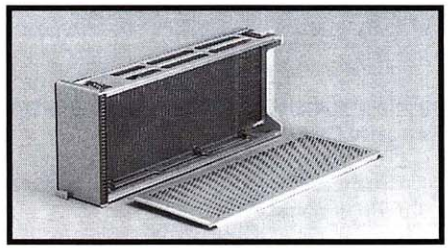
The viewing accessories normally mount on the instrument graticule cover. Some may fit camera-mounted bezels. If you intend to use a camera on your instrument, check with your Tektronix Sales Engineer for bezel-viewer compatibility.



Folding Viewing Hoods



Non-collapsible Viewing Hoods



BLANK PLUG-IN CHASSIS
Available for all Tektronix mainframes. The 11000 Series provides a blank plug-in only. The 7000 Series includes a bare printed circuit board.

BLANK PANEL
When operating the 5000/7000 Series mainframes or the TM 500/TM 5000 Series mainframes with less than a full complement of plug-ins, the blank panel may be used to cover an unused compartment. The panel for the 7000 Series is also good for EMC Shielding.

PLUG-IN STORAGE COMPARTMENT
The plug-in storage compartment provides storage space for probes, cables, "tees", accessories, and small tools. Inside dimensions: 250 mm long x 51 mm wide x 106 mm high (9-7/8 x 2 x 4-1/4 inches).

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

FOLDING BINOCULAR
For 2200 Series, 2445A/B, 2465A/B, 2467B, 271X/A Family, 434, 455, 464, 466, 465B, 475, 475A. Order 016-0566-00.

COLLAPSIBLE
To reduce reflections and glare under high ambient light. Blue vinyl, folds flat for storage. For 2200 Series, 2445A/B, 2455A, 2465A/B, 2467B, 271X/A Family, 432, 434, 455, 465/B, 475, 464, 466 (Polarized). Order 016-0180-00.

For 2200 Series, 2445A/B, 2465A/B, 2467B, 271X Family, 464, 466, 455, 465, 465B, 475 (Non-polarized). Order 016-0592-00.

FOLDING
For 576. Order 016-0259-00.

For 577, 5000, 7000, 11000 Series. Order 016-0260-00.

NON-COLLAPSIBLE
For Older Tektronix 5-in. Oscilloscopes. Order 016-0001-01.

BLANK PLUG-IN CHASSIS
11000 Series. Order 016-0829-00.

7000 Series. Order 040-0553-04.

5000 Series. Order 040-0818-04.

TM 500 Series. Order 040-0652-06.

BLANK PANEL
7000 Series. Order 016-0155-00.

5000 Series. Order 016-0452-01.

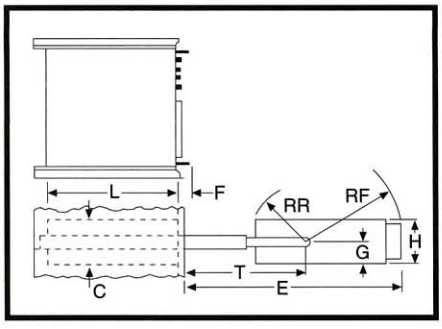
TM 500/TM 5000 Series. Order 016-0195-05.

PLUG-IN STORAGE COMPARTMENT
Order 016-0362-02.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Additional Accessories



Dimensions – Exclusive of Plug-in Units and Probes.

Symbol	Definition
H	Height of front panel
L	Rack front to rearmost permanent fixture excluding cables
F	Back of front panel to foremost protrusion
E	Maximum forward clearance with instrument out and horizontal
D Min.	Minimum mounting depth from front mounting rail to rear mounting rail
D Max.	Maximum mounting depth from front mounting rail to rear mounting rail

RACKMOUNT KIT SELECTION GUIDE

		H		L		F		E		D Min.		D Max.	
Instrument	**Part Number**	**in.**	**cm**	**in.**	**cm.**	**in.**	**cm**	**in.**	**cm**	**in.**	**cm**	**in.**	**cm**
DSA 601, DSA 602, 1201/A, 11301/A, 11302/A, 11401, 11402/A, 11403/A	040-1214-03	12.25	31.1	24.3	61.7	2.4	6.1	31.7	80.5	14.63	37.2	27.75	70.49
11801, 11802, CSA 803A, SM11	040-1214-03	8.75	22.3	21.6	55.0	–	–	–	–	14.63	37.2	27.75	70.49
7704A, 7104, 7934, 7854, 7904A	040-0611-01	15.75	40.0	21.63	54.9	1.25	3.18	30.48	77.4	–	–	–	–
7704A, 7104, 7934, 7854, 7904A	040-0560-00*[1]	22.0	55.9	21.9	55.6	1.98	5.0	–	–	–	–	–	–
5100, 5400 Series	040-0583-03	5.25	13.3	19.0	48.3	1.1	2.8	24.6	62.5	–	–	–	–
279X Family	016-0844-02	8.75	22.3	17.8	45.2	–	–	–	–	–	–	–	–
278X Family	016-1019-01	8.75	22.3	17.8	45.2	–	–	–	–	–	–	–	–
271X Family	016-0901-01	5.25	13.3	16.3	41.4	1.84	4.67	–	–	–	–	–	–
2400 Series (with DV or DMM Opt.)	016-0805-00	8.75	22.3	18.3	46.5	1.8	4.5	24.8	62.9	12.8	32.5	26.8	68.1
2400 Series (w/o DV or DMM Opt.)	016-0825-01	7.0	17.8	18.3	46.5	1.8	4.5	24.8	62.9	12.8	32.5	26.8	68.1
2402 TekMate™	016-0971-00	3.5	8.9	18.0	45.7	1.8	4.5	24.5	62.2	11.0	27.9	23.0	58.4
2335	016-0468-00	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2220, 2221, 2224, 2230, 2232		5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
1240, 1241	016-0789-00	8.75	22.3	17.75	45.1	1.13	2.9	–	–	–	–	–	–
490 Series	016-0844-02*[1]	8.75	22.3	17.75	45.1	4.7	11.9	–	–	–	–	–	–
TAS 200/400 TDS 300/400	016-1166-00	7.0	17.8	18.3	46.5	2.2	5.6	24.8	62.9	12.8	32.5	24.5	62.2
TDS 500/600/700	016-1236-00	7.0	17.8	22	55.9	16.3	41.4	–	–	–	–	–	–
TM 5003	040-1257-02	7.0	17.8	18.0	45.7	–	–	–	–	–	–	–	–
Two TM 503s side by side	040-0616-02	5.3	13.5	16.5	41.9	1.1	2.8	24.6	62.5	–	–	–	–
TM 503 with 1/2 Rackwidth Adapter	040-0617-02	5.3	13.5	16.5	41.9	1.1	2.8	24.6	62.5	–	–	–	–

[1] Cradle mount to rackmount a cabinetized instrument.

[2] For the 2211, 2201, 2225, 2205 oscilloscopes, and the 2815 Opto-Electronics scope when ordered with a rackmount kit (Option 1R) from the factory, the front feet of the instrument are removed. This reduces instrument height by one-half inch and cannot be reversed. When a field retrofit rackmount kit is installed, the instrument feet will remain integral to the instrument.

Additional Accessories

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CATHODE-RAY TUBE LIGHT FILTERS

Instrument*1	Color	Part Number
200 Series	Blue	378-0691-00
324/335	Blue	378-2016-01
490	Amber	378-0115-01
	Gray	378-0115-02
	Blue	378-0115-00
434	Blue	378-0678-01
455/465M	Blue	337-2122-00
465/465B	Blue	337-1674-00
475	Clear	337-1674-01
464/466	Smoke-gray Filter	337-1674-07
576	Blue*2	378-0616-00
603/604	Clear (603*2)	337-1440-00
	Green	337-1440-01
	Amber	337-1440-02
	Blue	337-1440-03
	Gray	337-1440-04
	Graticule (8 x 10 div)	331-0303-00
605/606/607	Blue	337-1674-00
	Graticule (Clear)	337-1674-10
	Clear Shield	337-1674-13
	Gray*2	337-1674-06
608	Amber	378-0704-00
	Graticule*2	337-2126-02
2200 Series	Blue*2	337-2775-00
	Clear	337-2775-01
	Gray w/TV Graticule	035-0175-00
2300 Series	Blue Implosion Shield*2	337-2760-00
2400 Series	Blue*2	378-0199-03
	Clear Implosion Shield*2	378-0208-00
271X Series	Smoke Gray	337-2775-02

CATHODE-RAY TUBE LIGHT FILTERS

Instrument*1	Color	Part Number
5100 & 5400 Series (except 5441)	Clear	337-1440-00
	Green	337-1440-01
	Amber	337-1440-02
	Blue	337-1440-03
	Gray	337-1440-04
5441	Clear*2	337-1674-01
	Gray	337-1674-07
7603	Blue	378-0684-00
	Amber	378-0684-01
	Gray	378-0684-02
	Green	378-0684-03
	Spectrum Analyzer Graticule	337-1439-01
	Blue Implosion Shield*2	337-1700-01
	Clear Implosion Shield	337-1700-04
7613/7623/7623A/7633	Spectrum Analyzer Graticule	378-0625-07
	Green (UV)	378-0625-08
7844/7313	Blue*2	378-0625-00
7700 Series/7613/7623/7100 Series/7900	Amber	378-0625-01
	Gray	378-0625-02
	Green	378-0625-03
	Gray TV Graticule NTSC	378-0625-06
	Clear Shield	
	Spectrum Analyzer Graticule	337-1159-02

CRT MESH/EMC FILTERS

Instrument*1	Color	Part Number
314/326/335	N/A	378-0063-00
432/434	N/A	378-0682-00
422/491/453A/454A/485	N/A	378-0648-00
465/465B/475/464/466/434	N/A	378-0726-01
7400/7603	N/A	378-0696-00
7100/7500/7700/7800/7900 Series/7613/7623/A/7633	N/A	378-0603-00

The mesh filter improves display contrast for instrument viewing under high ambient light conditions. A fine metal screen with a matte black surface is utilized to reduce light reflections. Although light transmission from the CRT is reduced to approximately 28%, the high attenuation of external reflections allows viewing low intensity displays in room light or other bright surroundings.

The mesh filter also serves as an EMC filter. Installed on the instrument, the metal frame of the filter is grounded, providing effective filtering of the EMC spectrum.

**1 For cabinet and rackmount instruments unless otherwise noted.*

**2 Standard filter supplied with instrument.*

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

Television Test Products

As new video technologies emerge and proliferate, one name above all others identifies the products that help make it all work. And keep working...Tektronix.

Tektronix delivers the test and measurement tools to help create and distribute television throughout the world. We've been a part of the committees that define industry standards. And, our developments and contributions to television technologies have earned Tektronix eight Emmy awards, one Oscar and over 130 video patents.

Solutions for design, manufacturing, maintenance and calibration - you'll find them all in the broad range of Tektronix video and audio test products.

CONTENTS

MPEG TEST SYSTEM

MTS 100 534
MTG200 535
MTD200 537

MEASUREMENT SETS

VM 700T 539
VM100/VM101 541
1780R/1781R 541

WAVEFORM MONITORS/VECTORSCOPES

1710J, 1711J, 1720, 1721, 1725, 1720 SCH, 1721 SCH, 1730, 1731, 1735, 1730D 542
1735 HD, 1740A, 1750A, 1760 Series 542
WFM 90, WFM 91, WFM 300A WFM601A, WFM601E 544
WVR 500 545

GENERATORS/INSERTERS

TG2000 546
TSG 170D 547
TSG 422 547
SPG 422, ECO 422 548
TSG 95, TSG 100, TSG 111, TSG 120 549
TSG 130A, TSG 131A, TSG 200 550
SDA 601, TSG 601 551
TSG 271, TSG 170A 552
SPG 1000 553
TSG 1001 553
VITS 100, VITS 200, VITS 201 553
1910 553

AUDIO

764 556
760A, 760D, 760N 557
ASG 100/ASG 140 557
UPD04, UPD05 558
AM700 559
UPL 560
AM70, ASW100F/100M 561

RF/CABLE

CMP500, CSS500, CMP100 562
DS1200, TV1350 563
DS1001 564
RFM150 SignalScout™ 566
DVT200 568
DDS200 570
2714, 2721A, 2722A, 1705A 572

MPEG Test System
MTS 100

Features

MPEG TRANSPORT STREAM SIGNAL SOURCE
- Bit Rates up to 60 MB/s
- Multiplex Video/Audio/Data
- Up to 20 Programs/Stream
- Up to 10 Elements/Program
- Suite of Elementary Data
- Parameters for Stressing
- Channel Coding

MPEG TRANSPORT STREAM ANALYZER
- Acquire at up to 60 MB/s
- Automatic Analysis
- 8 GB of Active Data Storage
- Hierarchical Data Display
- Program Association Table
- Program Map Tables
- Point-and-click Analysis of Transport & PES Packets, Field Syntax & Semantics
- Graph System Time Stamps
- Identify I, P, B Frames
- T-STD, LTW, Buffer Smoothing

MULTIPLE DATA I/O PORTS
- TTL Serial Data and Clock
- CCIT G.703
- ECL Parallel and Serial
- Control Port
- RS422 Serial Data and Clock
- Others Under Development

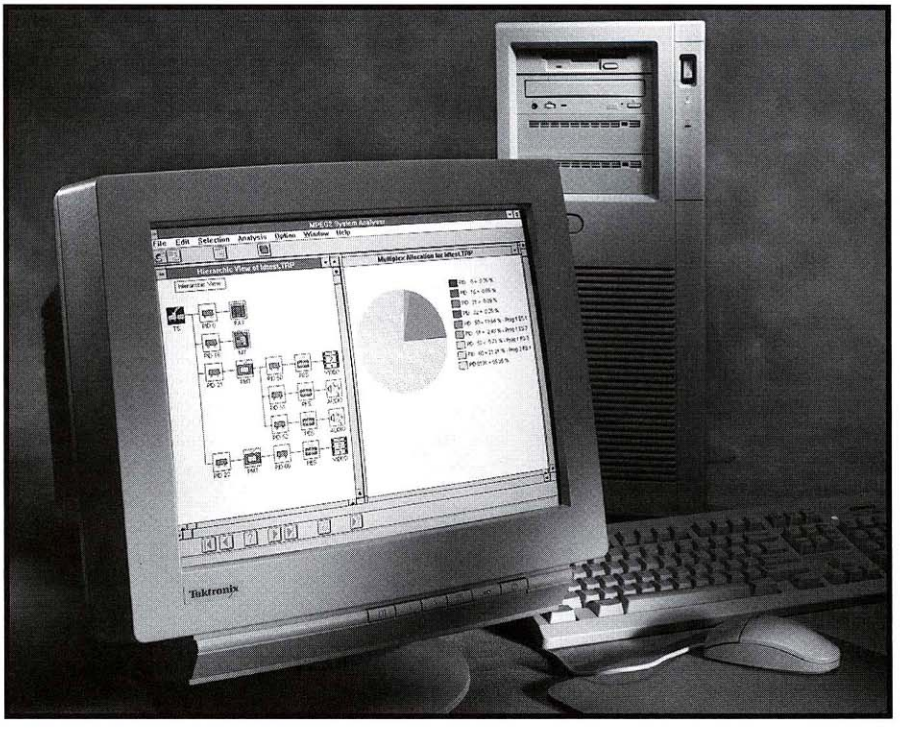
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.



The MTS 100 MPEG Test System generates, acquires and analyzes MPEG 1 and 2 digitized and compressed video, MPEG 2 audio and data transport streams. From a single program with one audio or video elementary stream, to multiple elementary streams in multiple programs, the MTS 100 provides an extensive variety of streams.

Output and acquisition of transport stream data is at rates from 1 to 50 MB/s. Based on the available 8 GB of hard disk capacity (20 min at 45 MB/s), output and acquisition may be either of limited length, determined by a single file, or continuous using end-to-start looping.

A Windows NT workstation is the platform for the MTS 100. Fully configured by Tektronix, the MTS 100 includes the Data Store System and five application programs. Transport stream I/O is provided on a variety of hardware interconnections, including TTL serial and ECL parallel.

Pre-formed transport stream files are provided with the MTS 100, including useful test signals and motion sequences. Using the MTS Multiplexer application, an immense variety of transport streams may be formed based on Tektronix supplied or user supplied elementary data files. Sarnoff MPEG Compliance Bitstreams (525-line system only), which provide an independent certification of MPEG interoperability, are available as an option.

Analysis of transport stream data (in files acquired by the Data Store system) is accomplished with the Windows-based MTS Analyzer. In addition to being a very intuitive analysis program, the MTS Analyzer provides a tutorial view of the MPEG transport stream, including definitions of each field in the transport stream and PES packets, as well as the program association table and map tables.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

MTS 100
MPEG Test System.

MEASUREMENT SERVICE OPTIONS
Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

MPEG Test Generator

New MTG200

Features

MTG200

- Seamless Looping of MPEG2 Transport Streams
- Real TIme Updating of All Time Stamps (PCR, PTS, DTS)
- Complies with DVB specification A010
- Wide Choice of Transport Streams in 525- and 625-Line Standard
- Output Data Rate can be Varied to Meet Specifications of Transmission Link or Device Under Test
- PC Card (PCMCIA) Interface to Store and Exchange User-Defined Transport Streams

Applications

- High-Volume Manufacturing of Modulators, Re-multiplexers, Decoders, and Receivers
- Substitution Signal Source for Troubleshooting Signal Distribution and Transmission Networks
- Stress Testing of Decoder PLLs Using Built-In Program Clock Reference (PCR)

MTG200

The Tektronix MTG200 MPEG Test Generator produces continuous, seamless transport streams in compliance with the MPEG2 standard. With this unique capability, the MTG200 is the perfect fit for high-volume manufacturing lines where continuous, error-free transport streams are required for maximum throughput.

Transport streams generated by the MTG200 contain video, audio, and data (e.g., teletext) sequences. PID values and the data rate of the transport stream can be set with dedicated controls on the front panel. All time stamps in the signal are updated in real time.

The Tektronix MTG200 has a parallel and two serial signal outputs as stipulated by DVB specification A010. It contains a variety of predefined MPEG2 transport streams which can be recalled at a keystroke. The transport streams are made up of several packetized elementary streams and include video, audio, and other data (e.g., teletext). Video data streams of different contents and data rates are available. The signal set comprises sequences representing moving picture contents and a number of static test patterns including patterns for automatic measurements in analog domain. Audio data streams, which are likewise available at different data rates, comprise sound accompanying video sequences, excerpts from music compositions, and special audio test signals.

In addition to the predefined transport streams stored in the generator, user-defined transport streams can be configured from existing Packetized Elementary Streams (PES) and stored in the unit with the aid of optional software without using an external PC. For this purpose, the MTG200 is equipped with interfaces to connect a PC keyboard, VGA monitor, mouse, and printer. This software may also be used with an external PC. A front-panel PCMCIA interface makes it possible to transfer comprehensive user-defined transport streams between systems.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

MPEG Test Generator
MTG200

Characteristics

OUTPUT SIGNALS

Standard – Transport signals to ISO/IEC 1-13818.

Data Rate (including null packets) – 0.6 to 60 Mbit/s (settable in 1 Hz steps).

Data Rate for Video/Audio Contents – Up to 15 Mbit/s.

Data Quantity of Video/Audio Contents – Up to 100 Mbit.

MPEG2 Sequence Length – Endless loop.

Video/Audio Sequence Length – Typically 192 video frames, depending on data rate for video/audio channels.

Length of Transport Stream Packets – 188/204 bytes (settable).

Stored Signals – Various transport streams, moving picture sequences, test patterns, and test tones.

Error of Data Rate – ±3 ppm with 1 year calibration interval. Additional ±0.5 ppm error per year without calibration.

Data Jitter – Typically <0.05 VI_{p-p} (10 Hz to 100 kHz); Asynchronous Serial Interface (ASI) Outputs: Typically <0.1$_{p-p}$ (10 Hz to 8 MHz); Synchronous Parallel Output: Typically <0.02 VI_{p-p} (10 Hz to 200 kHz).

SIGNAL OUTPUTS

Synchronous Parallel MPEG2 Data Stream, LVDS – Standard: To DVB A010; Connector: Front-panel 25-Pin connector. Level: 410 mV_{p-p}, 1.25 V DC; Impedance: 100 Ω.

Asynchronous Serial MPEG2 Transport Stream – Standard: To DVB A010; Data Rate: 270 Mbit/; Connector: Front- and rear-panel BNC; Level: 800 mV_{p-p}; Impedance: 75 Ω.

Interface for Integrated Controller – PC keyboard; VGA monitor; Two RS-232 serial interfaces; Parallel printer interface; PCMCIA (PC Card).

ENVIRONMENTAL

Temperature Range – Operating: +5 to +50° C (rated from 0 to ±50° C); Storage: –40 to +70° C; Climactic Stressing: +25/+40° C cyclically at 95% RH.

Humidity – To IEC 68-2-30.

Vibration – Sinewave: 5 to 150 Hz, maximum 2 g at 55 Hz, 0.5 g from 55 to 150 Hz, complies with IEC 68-2-6, IEC 1010-1, MIL-T-28800 D class 5; Random: 10 to 300 Hz, 1.2 g_{RMS}.

Shock – 40 g shock spectrum, complies with MIL-STD-810 C and MIL-T-28800 D class 3 and 5.

Electromagnetic Compatibility – To EMC directive of EU (89/366/EEC) and German EMC legislation.

Safety – To EN 61010-1.

POWER

Line Voltage – 88 to 264 VAC.

Line Frequency – 47 to 63 Hz.

Power Consumption – 50 W.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	43	1.75
Width	434	17.1
Depth	460	18.1
Weight	**kg**	**lbs.**
Net	5	11

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

MTG200
MPEG Test Generator.
Includes: Power Cord, Null Modem Cable, Operating Manual.

RECOMMENDED ACCESSORIES

Rackmount Adapter for 19 in. Rack – Order ZZA-91.

WARRANTY

One year, covering all labor and parts.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

MPEG Test Decoder

MTD200

Features

MTD200

- Real-Time Measurements and Simultaneous In-Depth Analysis
- Analyzer and Decoder in a Single Unit
- 19 Simultaneous Digital Video Broadcast Measurements
- Trigger-on-Error Function
- Integrated Long-Term Report
- On-Screen Display (with VIdeo Monitor)
- Remote Control via RS-232
- PC Card (PCMCIA) Interface for Descrambling Card

Applications

- Monitor MPEG2 Signal Distribution and Transmission
- In-Studio Monitoring of MPEG2 Signals
- Production and Servicing of MPEG2 Equipment and System Components

The Tektronix MTD200 MPEG Test Decoder is a low-cost, real-time analyzer for conformance checking of MPEG2 transport streams. Featuring a built-in decoder for audio and video signals, the MTD200 is optimized for operational monitoring applications. It has one parallel and two serial inputs as stipulated by Digital Video Broadcast (DVB) specification A010. All menus for operation of the decoder and measurement values are displayed on a front-panel two-line LCD. These menus and data can also be output to an external video monitor.

ANALYZER

The analyzer functions of the MTD200 provide a real-time protocol analysis of the measured MPEG2 transport stream. All measurements are in compliance with the Measurement Guidelines for DVB Systems (ETR 290). Any detected errors are displayed on the front-panel LEDs. Error statistics are compiled showing how often a particular type of error has occurred within a specified time interval.

A trigger function allows analysis of the transport stream down to the bit level by freezing part of the transport stream data (approximately 2 Mbit) upon the occurrence of a defined error. The frozen data set can be output via the integrated RS-232 interface for more detailed examination.

DECODER

An MPEG2 transport stream usually consists of a number of programs which may contain video, audio, and data streams (elementary streams). The Tektronix MTD200 decodes a user-selected video and audio stream from any chosen program. The decoded video signal is simultaneously output in analog composite and Y/C as well as digital serial ITU-R601 formats. Audio signals are output as analog stereo signals and as digital AES/EBU signals. The MTD200 can even decode scrambled data streams using an optional PCMCIA descrambling card.

The MTD200 lists all programs contained in the data stream with their names and measured data rates. Each program is analyzed as to its elementary streams including PIDs (Packet IDentification) it contains and associated data rates. Furthermore, all scrambled elementary streams are marked.

REMOTE CONTROL

The MTD200 can be fully remote-controlled via the built-in RS-232 interface.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

MPEG Test Decoder

MTD200

Characteristics

INPUT SIGNALS

Transport Stream – To ISO/IEC 1-13818.

Data Rate of Transport Stream – Up to 54 Mbit/s.

Length of Data Packets – 188/204 bytes.

SIGNAL INPUTS

Synchronous Parallel MPEG2 Transport Stream – (LVDS, to DVB-A010); Connector: Front- and rear-panel 25-Pin connector; Level: 100 mV_{p-p} to 2 V_{p-p}; Impedance: 100 Ω.

Asynchronous Serial MPEG2 Transport Stream, 270 MBit/s – (ASI, to DVB-A010); Connector: Front-panel BNC; Level: 200 mV_{p-p} to 1 V_{p-p}; Impedance: 75 Ω.

SIGNAL OUTPUTS

Composite Video – (PAL, SECAM, NTSC); Connector: Front- and rear-panel BNC; Level: 1 V_{p-p} ±1%; Impedance: 75 Ω.

Luminance (Y) –
Connector: Rear-panel BNC;
Level: 0.7 V_{p-p} ±1%; Impedance: 75 Ω.

Chrominance (C) –
Connector: Rear-panel BNC;
Level: 0.7 V_{p-p} ±1%; Impedance: 75 Ω.

C/L Gain – ±2%.

C/L Delay – ±30 ns.

Return Loss – (0 to 6 MHz) 34 dB;
At Front-panel Composite Connector: 30 dB.

Frequency Response – (typical values)
0 to 3 MHz: +1%/–2%;
<4 MHz: +1%/–5%;
<5 MHz: +1%/–15%.

Serial Digital Video – (ITU-R 601)
Connector: Rear-panel BNC;
Level: 800 mV_{p-p}; Impedance: 75 Ω.

Analog Audio – (Left, Right)
Connector: Front- and rear-panel LEMO Triax.; Impedance: 50 Ω; Level (full scale): 6/9/12/15 dBu ±0.5 dB; Frequency Response (40 Hz to 15 kHz): ±0.5 dB relative to 1 kHz; S/N Ratio: >70 dB, unweighted; THD: >70 dB.

Digital Audio – (AES/EBU)
Connector: Rear-panel LEMO Triax;
Level: 4 V_{p-p}; Impedance: 110 Ω.

Interface – RS-232 serial interface for remote control or printer.

ENVIRONMENTAL

Temperature Range –
Operating: +5 to +40° C;
Storage: –40 to +70° C;
Climactic Stressing: +25/+40° C cyclically at 95% RH.

Humidity – To IEC 68-2-30.

Vibration – Sinewave: 5 to 150 Hz, maximum 2 g at 55 Hz, 0.5 g from 55 to 150 Hz, complies with IEC 68-2-6, IEC 1010-1, MIL-T-28800 D class 5; Random: 10 to 300 Hz, 1.2 g_{RMS}.

Shock – 40 g shock spectrum, complies with MIL-STD-810 C and MIL-T-28800 D class 3 and 5.

Electromagnetic Compatibility – To EMC directive of EU (89/336/EEC) and German EMC legislation.

Safety – To EN 61010-1.

POWER

Line Voltage – 88 to 264 VAC.

Line Frequency – 47 to 63 Hz.

Power Consumption – 50 W.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	43	1.75
Width	434	17.1
Depth	460	18.1
Weight	**kg**	**lbs.**
Net	4.9	10.8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

MTD200
MPEG Test Decoder.
Includes: Power Cord, Audio Adapter (LEMO Triax to XLR), Operating Manual.

RECOMMENDED ACCESSORIES

Rackmount Adapter for 19 in. Rack –
Order ZZA-91.

WARRANTY
One year, covering all labor and parts.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Measurement Sets

New VM 700T • Automatic Video and Audio Measurements

Features

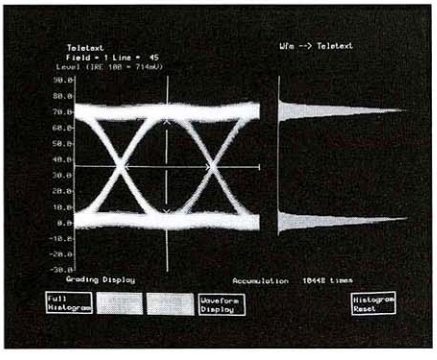
VM 700T

- Video Measurement Set
  - Opt. 01 – NTSC Measurements
  - Opt. 11 – PAL Measurements
  - Opt. 20 – Teletext Measurements
  - Opt. 21 – Camera Measurements
  - Opt. 22 – Drift Rate Measurements
  - Opt. 30 – Component Measurements
  - Opt. 40 – Audio Measurements
  - Opt. 41 – Three Stereo Audio Inputs
  - Opt. 42 – Audio to Video Delay Measurement
  - Opt. 48 – GPIB Interface
  - Opt. 74 – White Phosphor CRT
  - Opt. 1C – Cabinet Version
  - Opt. 1P – Printer (110 V only)
  - Opt. 1Z – Probe Adapter

New VM 700T

VM 700T Video Measurement Set

- Many capabilities in one instrument
  - Digital waveform monitor
  - Digital vectorscope
  - Group delay and frequency response
  - Noise measurement set
  - Automatic measurement set
- Auto Mode
  - Unattended monitoring of NTSC or PAL video signals from studios, STLs, earth stations, and transmitters
  - User-specified limits
- Remote control operation
- Automatic measurement of short duration audio test sequence
- Measure frequency response, distortion, phase, crosstalk, and other important audio parameters
- Measure mode provides graphic display of measurements
  - K factor
  - Differential gain and phase
  - Chrominance to luminance delay
  - Noise spectrum
  - Group delay with (Sin x)/x
  - Color bars
  - Relative-to-reference on most measurements
- Three input channels
- Averaging on most measurement modes
- Picture mode for source ID
- Hardcopy for analysis and documentation



VM 700T Option 20 Teletext Measurements

- Provides numerical results
  - Eye height
  - Start of data code
  - Eye width
  - Number of run-in bits
  - Data levels (logical "0" and logical "1" levels)
- Provides graphical displays
  - Eye height with variable persistence
  - Eye height with grading
  - Amplitude histogram
  - Teletext timing
- Multiple clock frequencies
  5.727272 MHz for System M (NTSC)
  6.9375 MHz for System B/G/I (PAL)
- Cursors for manual measurements

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

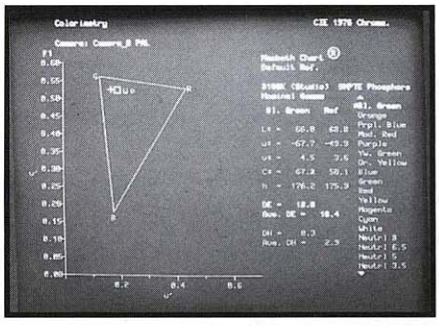
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

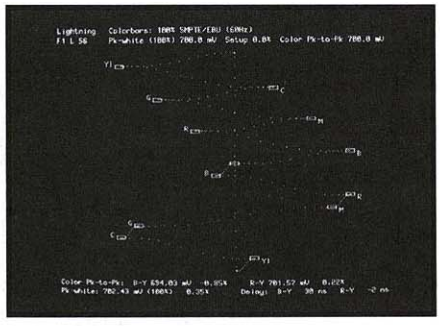
For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

Video Measurement Sets

Component Measurements • AVTIME



VM 700T Option 21.



VM 700T Option 30.

VM 700T Option 21 Camera Measurements

- Significantly simplifies key measurements of camera performance
- Compatible with NTSC or PAL cameras
- Automates pre-purchase evaluation and comparison of cameras
- Reduces time spent on acceptance testing, routine maintenance and operational adjustments
- Uses industry standard charts
- Camera matching simplified with relative-to-reference mode
- Ten key measurements:
  - Colorimetry
  - CDD Defects
  - Vertical Smear
  - Shading
  - Gamma
  - Detail
  - Fixed Pattern Noise
  - Geometry/ Registration
  - Frequency Response
  - Frequency Response with Aliasing

VM 700T Option 30 Component Measurements

- Provides numerical results for:
  - Relative timing of B-Y and R-Y
  - Relative amplitude of B-Y and R-Y
  - Peak to peak amplitude for B-Y and R-Y
  - Peak white amplitude
- Compatible with SMPTE/EBU, Sony Betacam, and MII Formats
- Numerical results in all measurements
- Level meter displays amplitude of all three channels simultaneously
- Configurable for Y/R-Y/B-Y or GBR formats
- Full complement of component analog video measurements and displays

VM 700T Option 40/41

- Automatic measurement of short duration audio test sequence
- Combined video and audio performance reports
- Real-time spectral response
- Real-time multitone analyzer
- Stereo audio input
  - Single (Option 40)
  - Three (Option 41)
- Measure frequency response, distortion, phase, crosstalk, and other audio parameters

VM 700T Option 42 Audio to Video Delay Measurement

Option 42 provides the VM 700T with the capability to measure the timing difference between the audio and video portions of a program. The measurement is designed to operate with a Tektronix VITS 200 NTSC VITS Inserter or VITS 201 PAL VITS Inserter, and a Tektronix ASG 140 Audio Signal Generator.

- Measures audio to video delay of transmission paths
- Operates in both NTSC and PAL video standards
- Measures audio to video delay of up to 120 video frames
- Easy to read graphic display

AVTIME Audio to Video Delay Measurement Package

Complete audio to video time delay measurement package including VM 700T with Option 40 audio measurement hardware, audio to video delay measurement Option 42, a VITS 200 Series Inserter, and an ASG 140 Audio Signal Generator.

- FFT mode for viewing low frequency wander spectrum

VM 700T Software

VMBKUP Backup and Remote Control Software

- Backup or restore sets of measurement configuration files, reference measurement files and function key definitions
- Perform individual file and directory operations on both the connected personal computer and VM 700T
- Use to restore backed up files to VM 700T after upgrade
- Control the VM 700T from a PC
- Use Serial Line Internet Protocol (SLIP) for data transfer over RS-232C connection

VMT Remote Control Software

- Controls the VM 700A or VM 700T
- Pull down/pop up menus simplify operation
- Conditional testing of incoming data
- PC based functions
- Text and graphics capture
- Adapts to VM 700T and its options

VMREMGR Remote Graphics Software

- Display VM 700T graphics on a remote PC
- Perform front panel operations via mouse
- Issue remote commands
- Terminal operations

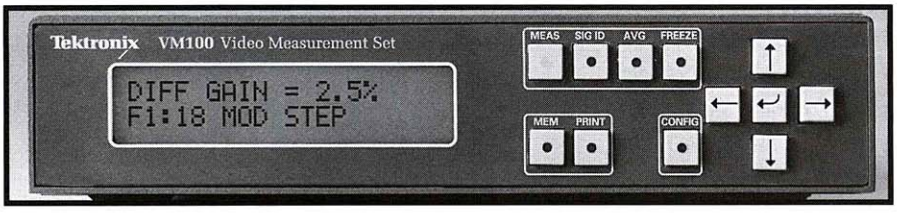
VM700T Option 22 Video Drift Rate Measurement

Option 22 provides an accurate means of measuring "Long Time" horizontal sync timing variations below 10 Hz. Option 22 measures frequency variations and, more importantly, the frequency drift of a video signal's horizontal sync timing.

- Accurately measures frequency variations and drift rate of horizontal sync timing
- Allows normalizing to external reference timing source for precise measurements
- Measurements reported in easy to understand units – PPM and Hz/s

Automatic & Analog Video Measurement Sets

1780R/1781R • New VM100/VM101

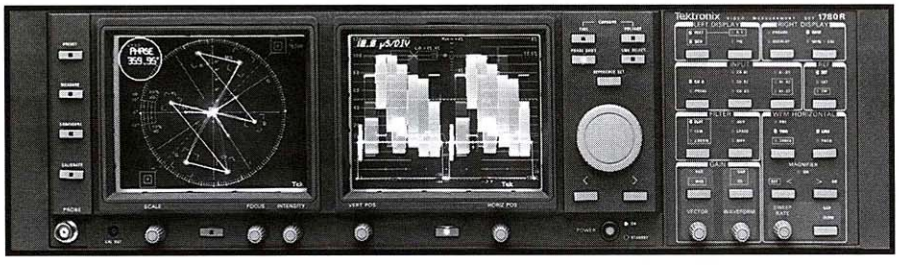


VM100/VM101

- Automatically Measures 13 Key Video Parameters:
  - Differential Gain
  - Differential Phase
  - Chrominance to Luminance Gain
  - Chrominance to Luminance Phase
  - Frequency Response
  - 2T K-Factor
  - Hum
  - Signal to Noise
  - Group Delay
  - Bar Amplitude
  - Sync Amplitude
  - Burst Amplitude
  - Luminance Nonlinearity

VM100/VM101 Low Cost Automatic Video Measurement Set

- Verifies compliance standard TV regulations
- Automatic "Signal ID"
- Fast, accurate measurements at the touch of a button
- Average Mode for accurate results in low signal to noise
- Freeze Mode suspends testing to view intermediate results
- RS-232C port for remote access or local printer output
- Simple and intuitive interface
- Internal memory for storage of measurement results
- Internal time clock for dating measurement results
- Available in NTSC or PAL standards



1780R/1781R

- Analog Waveform and Vector Displays
- Touch Screen Control
- 20 MHz Signal Bandwidth
- Bright Line Select
- On-screen Prompts Guide User Through Key Video Performance Measurements

1780R/1781R Video Measurement Sets

- Full bandwidth analog processing
- Precision waveform/vector measurements
- Polar SCH presentation with calibration mode
- Four loop-through video input channels
- Component or composite waveform evaluation
- Measurement-grade time/voltage cursors
- Precision differential phase/differential gain measurements even with noisy signals
- Stereo audio phase and amplitude display
- User definable semi-automatic setups
- Available for either NTSC or PAL standards

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

VM 700T
Video Measurement Set.

Opt. 01 – NTSC Measurements.
Opt. 11 – PAL Measurements.
Opt. 20 – Teletext Measurements.
Opt. 21 – Camera Measurements.
Opt. 22 – Drift Rate Measurement.
Opt. 30 – Component Measurements.
Opt. 40 – Audio Measurements.
Opt. 41 – Three Stereo Audio Inputs.
Opt. 42 – Audio to Video Delay Measurement.
Opt. 48 – GPIB Interface.
Opt. 74 – White Phosphor CRT.
Opt. 1C – Cabinet Version.
Opt. 1P – Printer Version (110 V only).
Opt. 1Z – Probe Adapter (067-1429-00).

AVTIME – Audio to Video Delay Measurement Package
Opt. 01 – NTSC System with an ASG 140.
Opt. 02 – NTSC System with an ASG 100 in place of an ASG 140.
Opt. 11 – PAL System with an ASG 140.
Opt. 12 – PAL System with an ASG 100 in place of an ASG 140.
VMBKUP – VM 700T Backup and Remote Control Software.
VMREMGR – VM 700T Remote Graphics Software.
VMT – VM 700T Remote Control Software.
VM100 – Automatic Video Measurement Set (NTSC).
VM101 – Automatic Video Measurement Set (PAL).
1780R (NTSC)/1781R (PAL) – Video Measurement Sets.
Opt. 74 – White Phosphor CRT
1780F02 – Portable Carrying Case for 1780R/1781R.
1780F05 – Rackmount Shelf.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 (VM700T/VM100/VM101 only) – Repair warranty extended to cover three years.
Opt. R5 (VM700T only) – Repair warranty extended to cover five years.
Opt. S1 – One year upgrade to "On-site" Service.
Opt. S3 – Three year upgrade to "On-site" Service.
Opt. S5 – Five year upgrade to "On-site" Service.
Opt. IN – Product Installation Service.
See page 581 for further information.

Waveform Monitors/Vectorscopes

1710J/1711J • 1720/1730D/1740A/1750A/1760 Series

Features

1710J/1711J
- Waveform Monitors

1720/1721/1725
- Vectorscopes

1720 SCH/1721 SCH
- Vectorscopes with SCH

1730/1731/1735
- Waveform Monitors with Line Select

1730D
- Composite Digital Waveform Monitor

1735 HD
- HDTV Waveform Monitors

1740A SERIES
- Combination Waveform Vector Monitors

1750A SERIES
- Combination Monitors with SCH

1760 SERIES
- Combinations Component/Composite Monitors

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

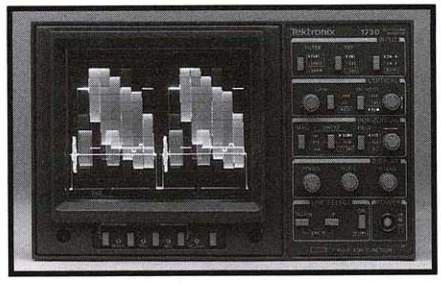
Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

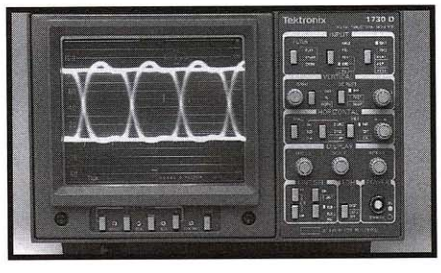
1710J/1711J
Waveform Monitors
- Easy operation/cost effective
- Flat, LowPass, and Chroma Filters
- Dual filter display
- Bright CRT display
- Available in NTSC or PAL standards

1720/1721/1725
Vectorscopes
- Performance and economy
- Simultaneous channel A and B display
- Stereo audio phase measurement
- R-Y output for differential phase measurement
- Available in NTSC, PAL or dual standard

1720 SCH/1721 SCH
Vectorscopes with Polar SCH Phase Display
- Polar display of relative and absolute SCH phase
- Full line select capabilities when used with 1730 Series Waveform Monitors
- White CRT phosphor available for neutral color display applications
- Stereo audio phase and amplitude display
- Especially useful in editing suites for matched frame editing
- Digital phase shifter
- Available in NTSC (1720 SCH) and PAL (1721 SCH) standards



1730/1731/1735
Waveform Monitors
- Performance and economy
- Complete line select
- Simultaneous channel A and B display
- Differential gain measurement
- One button front-panel recall
- Dual filter display
- VTR servo rates
- Available in NTSC, PAL or dual standard



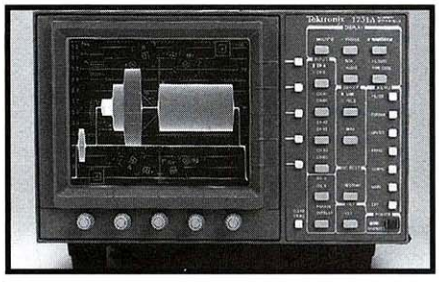
1730D
NTSC Serial Digital Waveform Monitor
- Two analog composite inputs
- Two serial digital composite inputs
- One parallel digital composite input
- Passive loop-through for serial inputs
- Precision analog display of digital input
- Full time DAC output
- Serial digital bit stream EYE Pattern display
- Error Detection and Handling display mode (EDH)
- Displays D-2 servo waveforms

Waveform Monitors/Vectorscopes

1710J/1711J • 1720/1730/1740A/1750A/1760 Series

1735 HD
Multiformat Waveform Monitor

- Six video inputs
- 30 MHz video bandwidth
- Excellent performance in high magnifications
- High DC stability with front-panel ground reference
- HDTV and standard video formats
- Full line select in each format
- Subtract mode for intersignal timing



1740A/1750A Series
Analog Composite
Waveform/Vector Monitors

- Easy to use operating system
- Eight video inputs
- Waveform and vector displays
- Picture display for signal identification
- Stereo audio phase/amplitude display
- Time code waveform display
- Waveform and vector cursors
- Front panel presets
- 1750A includes Polar SCH and color framing

1760 Series
Composite/Component
Waveform/Vector Monitor

- Two composite plus two component inputs
- All composite features of the 1740A
- Component vector, Lightning and Diamond displays
- Component picture monitor output
- Optional SCH and color framing

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

1710J (NTSC)/1711J (PAL)
Waveform/Burst Phase Monitor.

1720 (NTSC)/1721 (PAL)
Vectorscope.

1725
NTSC/PAL Vectorscope.

1720 SCH (NTSC)/1721 SCH (PAL)
Vectorscope.

1730 (NTSC)/1731 (PAL)
Waveform Monitor.

1735
NTSC/PAL Waveform Monitor.

1730 D (NTSC)
Serial Digital Composite Waveform Monitor.

1735 HD
HDTV Waveform Monitor.

1740A (NTSC)/1741A (PAL)
Waveform/Vector Monitor.

1745A
NTSC/PAL Waveform/Vector Monitor.

1750A (NTSC)/1751A (PAL)
Waveform/Vector/SCH Monitor.

1755A
NTSC/PAL Waveform/Vector/SCH Monitor.

1760 (NTSC)/1761 (PAL)
Composite/Component Waveform/Vector Monitor.

1765 NTSC/PAL
Composite/Component Waveform/Vector Monitor.

Opt. SC – (1760/1761/1765)
Adds SCH/Color Framing Display.

Opt. 74 – P4 White Phosphor.
Available on all half-rack 1700 Series products.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

ACCESSORIES

1700F00 – Plain Case.

1700F02 – Portable Case.

1700F05 – Dual Rack Adapter.

1700F06 – Blank Panel.

1700F07 – Utility Drawer.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

Waveform Monitor/Vectorscop

WFM 90 • WFM 91 • WFM 300A • WFM 601A • WFM 601E• WFM 601M

Features

WFM 90
- Handheld NTSC Monitor

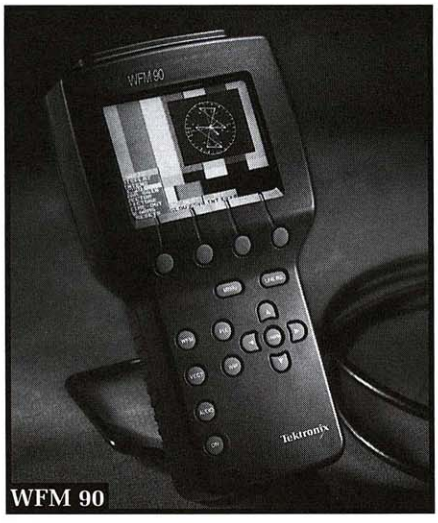
WFM 91
- Handheld PAL Monitor

WFM 300A
- Analog Component Monitor

WFM 601A
- Serial Component Monitor

WFM 601E
- Serial Component Monitor with Eye Patterns

WFM 601M
- Serial Component Measurement Set



WFM 90

WFM 90 and WFM 91 Handheld Waveform/Vector/Audio/Picture Monitors
- Video waveform, with 1H, 2H, 2F, and magnified displays
- Composite vector display, with x5 magnification
- Audio waveform voltage/time display
- High quality color picture display
- Waveform or vector displays cut into picture
- Output to external picture monitor
- Battery or AC operation with adapter
- Headphone output for audio identification and microphone checks
- Rugged package for field operation
- Available for NTSC (WFM 90) or PAL (WFM 91) operation

WFM 300A Component/Composite Waveform Monitor
- Component and composite waveform display
- Lightning display for equipment setup and monitoring
- Bowtie display for system timing
- Menu selectable component format options
- Menu selected 625/50 or 525/60 configuration
- Separate GBR and composite picture monitor outputs
- Front-panel user recalls for fast operation

WFM 601A/WFM 601E/WFM 601M Serial Component Monitors

WFM601 Series Features:
- Two serial digital component video inputs
- Waveform parade and overlay displays
- Bright line select display
- Component vector display
- Tektronix Diamond color gamut display
- Tektronix Lightning and bowtie displays
- Tektronix Arrowhead composite gamut display
- Waveform time and amplitude cursors
- EDH and data error reporting
- Active picture CRC readout
- Picture display of Y channel
- RGB picture monitor outputs
- Eight user presets

Features Unique to WFM 601E:
- Eye Pattern of 270 MB/s data signal
- Cable length and signal level metering
- ANC data identification
- Expanded data error reporting

Features Unique to WFM 601M:
- Video data logic analyzers display
- Numeric jitter readout and jitter waveform display

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

WFM 90 (NTSC)/WFM 91 (PAL)
Handheld Waveform/Vector/Audio/Picture Monitor.
Opt. 01 – Include NiCad Battery.
Opt. 33 – Travel Package.
Includes: Carrying Case, NiCad Battery, Desk Stand and Viewing Hood.

WFM 300A Component/Composite Monitor
Opt. 05 – Delete Color Shutter.
Opt. 10 – NTSC/BETACAM Transcoder.
Opt. 14 – NTSC/MII Transcoder.

WFM 601A Serial Component Monitor.

WFM 601E Serial Component Monitor with Eye Pattern.
WFM 601M Serial Component Measurement Set
MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

Waveform Monitor/Vectorscope
WVR 500

Features

WVR 500
- NTSC/PAL Waveform/Vector Rasterizer

(Monitor not included)

WVR 500 Waveform/Vector Rasterizer
- Rasterizes NTSC or PAL video signal for picture monitor display
- High quality display of live or test waveforms
- Full field or cut-in waveform and vector displays
- Safe title/safe action area indication
- No processing of picture, even in cut-in modes
- Line select for VITS observation
- Local or RS-232 control
- Small, single unit package
- Compatible with Tektronix mounting system
- Ideal for dual-standard applications
- Safety certified to UL, CSA standards

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

WVR 500
Waveform/Vector Rasterizer.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
See page 581 for further information.

Generators/Inserters

New TG2000

Features

•TG2000

New TG2000

The TG2000 is a multiformat, analog and digital, precision signal generation platform. Designed for the most demanding test applications, the TG2000 provides reference quality test signals, stressing functions in both the analog and digital domain, and the flexibility to address user-defined testing requirements. Comprehensive test signal libraries are supplied in all formats and are supplemented by a Windows based test signal development program. The modular architecture, RAM based test signal generators, and programmable system clocks ensure the TG2000 will meet future needs as well as today's requirements.

NEW TG2000 Signal Generation Platform

- Multiformat Analog and Digital Test Signal Generation
- Reference Generator Performance Level
- Programmable with Windows-based Software
- Conforms to Analog and Digital, Video and Audio Industry Standards
- Modular Expandable Platform
- Designed for the Requirements of Today and the Future
- Fully Supports VM 700A Video Measurement Routines
- RAM-based Test Signal Generators with Nonvolatile Storage
- Test Signal Libraries for All Formats
- Variable Analog and Digital Video Parameters
- Serial Digital Interface Stressing Functions (SDI Test Option)
- Circle and Text Overlays on Test Signals
- Simultaneous 525/59.94 and 625/50 Signal Generation
- High Stability Internal Reference
- External Reference to Composite and CW Signals
- Programmable System Clocks
- User Presets and Sequences
- Intuitive User Interface with On-screen Help
- GPIB, RS-232, Ground Closure Remote Control
- Easily Upgradeable Flash EPROM System Storage

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

WHEN ORDERING, PLEASE OBSERVE THESE SIMPLE GUIDELINES:

- At least one signal generation module must accompany each TG2000 mainframe.
- Only one AGL1 Genlock Module per TG2000 mainframe.
- Only one GP1 GPIB Interface Module per TG2000 mainframe.
- Signal generation modules (AVG1, DVG1, and AWVG1) may be combined in any mix desired up to the TG2000 mainframe limit of eight (seven when a genlock module is installed).
- Add Opt. 88 to each item ordered. This will ensure your TG2000 package will come assembled and calibrated as a single unit.
- Modules ordered to add to an existing TG2000 package do not require Opt. 88.

TG2000 – Generator Mainframe with BG1 Black Burst Generator.

AVG1 – Analog Video Generator.

DVG1 – Digital Video Generator.

Opt. S1 – SDI Test.

AWVG1 – Analog Wideband Video Generator.

AGL1 – Analog Genlock Module.

GP1 – GPIB interface.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

Generators/Inserters

TSG 170D • TSG 422

Features

- TSG 170D
- TSG 422

TSG 170D Digital Composite Generator

- NTSC digital and analog test signal outputs
- Optional serial digital video outputs
- Digital and analog audio tone outputs
- SMPTE RP 154 black burst output for master SPG application

TSG 422 Digital Component Generator

- D1 VTR and other 4:2:2 component digital equipment testing and maintenance
- Conforms to ITU-R BT.601/656, SMPTE 125M, and EBU Tech. 3267-E
- 10- or 8-Bit signal generation
- Digital video test signal outputs
- Serial digital video output (Opt. 1S)
- Separate Y, B-Y, R-Y clock outputs
- 525/60 and 625/50 operation
- NTSC or PAL black burst outputs
- Sync lock to 525/60 or 625/50

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TSG 170D
NTSC Digital Composite Generator.

Opt. 1V – VM 700T Signal Set.

Opt. 1S – Adds Serial Digital Video Outputs.

TSG 422
Digital Component Generator.

Opt. 1S – Adds Serial Digital Video Outputs.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(TSG 422)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

Generators/Inserters

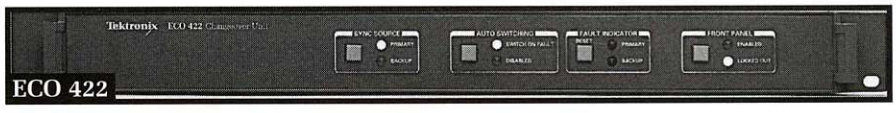
SPG 422 • ECO 422

Features

- SPG 422
- ECO 422

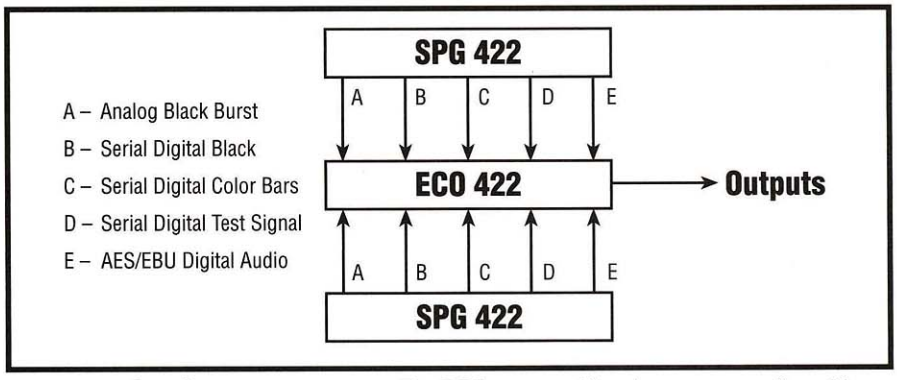
SPG 422 Component Digital Master Sync Generator

- PAL/NTSC, 525/625, or dual standard operation
- Multiple, independently timeable black burst outputs
- High stability internal reference with genlock
- Full time serial digital bars and black outputs
- AES/EBU digital audio outputs
- Optional serial digital test signal output
- RS-232 or ground closure remote control



ECO 422 Changeover Unit

- Switches analog black and serial digital video and audio
- Eleven user configurable signal channels
- Amplitude detection on all channels
- Automatic or manual operation
- Fault and operating mode indicators



Component digital master sync system. The ECO 422 provides eleven user configurable signal channels, each consisting of primary and backup inputs and an output.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SPG 422
Component Digital Master Sync Generator.

Opt. 01 – Adds Four Additional Analog Black Burst Output.

Opt. 02 – Adds a Serial Digital Test Signal Generator.

ECO 422
Changeover Unit.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

Generators/Inserters

TSG 95 • TSG 100 • TSG 111 • TSG 120

Features

- TSG 95
- TSG 100
- TSG 111
- TSG 120

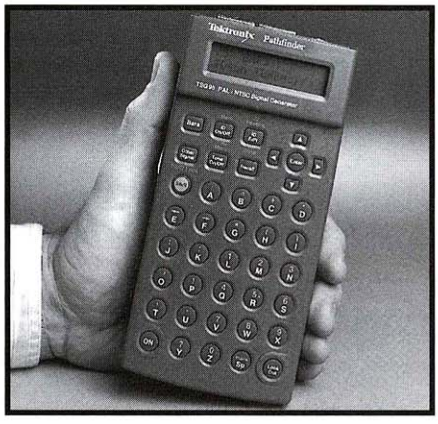
For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(TSG 111)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.



TSG 95 Handheld PAL/NTSC Signal Generator

PAL:
- 75%, 100% Bars
- 75% Bars over Red
- 100% Bars over Red
- Green, Blue, Red Field
- 100%, 50%, 0% Flat Field
- Multiburst
- 60% Reduced Line Sweep
- Bounce
- 5 Step (Gray Scale)
- Modulated 5 Step
- Convergence
- Plug
- Matrix
- Field Square Wave
- Safe Area

AUDIO:
- Stereo with Click ID
- Programmable Frequencies and Levels

NTSC:
- SMPTE Bars
- 75% Bars
- Multiburst
- Cable Multiburst
- Cable Sweep
- NTC7 Composite
- NTC7 Combination
- FCC Composite
- 5 Step (Gray Scale)
- Red Field
- Field Square Wave
- 30 IRE Flat Field
- 50 IRE Flat Field
- 0 IRE No Burst
- Black Burst
- Sin (x)/x
- Convergence
- Matrix
- Safe Area/Safe Title

CHARACTER ID:
- 2 16-Character Lines
- 4 Memories

TSG 100 NTSC Signal Generator

- Studio and transmission test signal sets
- 8-Bit digital generation
- Conforms to SMPTE RP 154 timing specifications
- 1 kHz audio tone
- H or V rate scope trigger signal
- DC power option
- Compact and lightweight

TSG 111 PAL Signal Generator

- Low cost test signal generator
- Tailored for service applications
- High accuracy (12-Bit) signal generation
- Two channels of audio tone with channel one identification
- Compact and lightweight

TSG 120 YC/NTSC Signal Generator

- Low cost test signal generator
- NTSC; Y, C and Y/C outputs
- Stereo audio outputs
- Ideal for equipment maintenance

Cable Option for TSG 120 (Option 02)

- Special signals to test cable systems to FCC requirements

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TSG 95 HANDHELD GENERATOR
Opt. 01 – NiCad Battery Pack.

TSG 100 NTSC TEST SIGNAL GENERATOR
Opt. 01 – Transmission Test Signal Set.
TVGF10 – Single Half-rack Mount (for TSG 100 only) to Mount to 1700F02.

TSG 111 PAL SIGNAL GENERATOR
Opt. 10 – ±5 Hz Internal Reference.

TSG 120 YC/NTSC GENERATOR
Opt. 01 – Adds Black Burst Output.
Opt. 02 – Cable Signal Set.

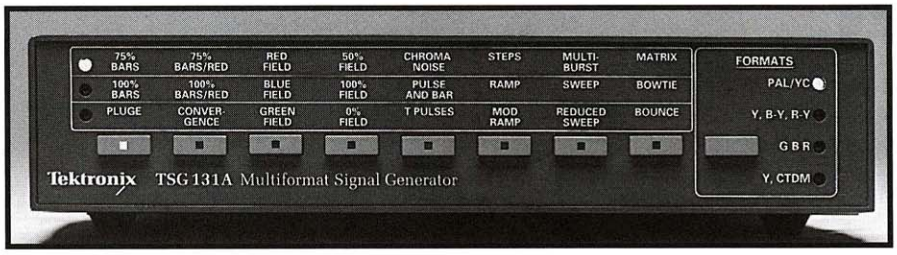
MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

Generators/Inserters

TSG 130A • TSG 131A • TSG 200

Features

- TSG 130A
- TSG 131A
- TSG 200



TSG 130A/TSG 131A Multiformat Generators

- Low cost test signal generator
- NTSC or PAL; Y,C; Y/C; Y, B-Y, R-Y; GBR and CTDM outputs
- Betacam or MII levels
- Optional black burst output
- Stereo audio outputs
- Ideal for equipment maintenance

TSG 200 NTSC Signal Generator

- NTSC test signals
- Multiple black burst outputs
- Character identification positionable within the active field
- Tape leader countdown with visual and audio cues
- Stereo audio tone with CH 1 identification
- 12 VDC input
- Remote control
- Applications:
  - Compact production system SPG
  - Bars/ID source for microwave links

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(TSG 130A, TSG 131A)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TSG 130A
Multiformat Generator (NTSC).
Note: Only Opt. 01 and 02 may be combined.
Opt. 01 – MII Test Signals (replaces Betacam signals).
Opt. 02 – Adds a Dedicated Black Burst Output.
Opt. 2J – 0 IRE Setup and Black Burst.
Opt. 03 – Sony PVW Series Service.
Includes: Special test signal set, black burst output, and TTL level color frame pulse output.
Opt. 04 – Panasonic MII Service.
Includes: Special test signal set and TTL level comp sync and frame pulse outputs.

TVGF11A – Single Rack Mount Adapter.
TVGF13 – Dual Rack Adapter.
TVGF14 – Dual Half-rack Adapter.

TSG 131A
Multiformat Generator (PAL).
Note: Only Opt. 01 and 02 may be combined.
Opt. 01 – MII CTCM Signals.
Opt. 02 – Adds a Dedicated Black Burst Output.
Opt. 03 – Sony PVW Series Service.
Includes: Special test signal set, black burst output, and TTL level color frame pulse output.
Opt. 04 – Panasonic MII Service.
Includes: Special test signal set and TTL level comp sync and frame pulse outputs.
Opt. 10 – ±5 Hz Internal Reference.

TSG 200
NTSC Signal Generator.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

Generators/Analyzer

TSG 601 • SDA 601

Features

- TSG 601 Serial Digital Generator
- SDA 601 Serial Digital Analyzer

SDA 601/TSG 601

TSG 601/SDA 601 Serial Digital Component Data Analysis Set

The TSG601 Serial Component Generator provides Serial Digital Interface (SDI) check field test signals that stress receiver clock recovery and phase lock loop circuitry. Data signal launch amplitude may be varied over the SMPTE specification range to check equalizer performance, and a built in 50 meter cable simulator may be used to quickly check available signal strength margin.

The SDA 601 Serial Digital Analyzer provides analysis of the incoming digital television signal with the push of a button, quickly identifying data errors and indicating the presence and status of SMPTE RP165 and other ancillary (ANC) data signals. The analysis results may be displayed on the built-in LCD screen, on a picture monitor, or transferred directly to a printer or PC for further analysis.

SDA 601 Handheld Serial Digital Analyzer

- Video Format Analysis
- Data Format Analysis
- Transport Layer Analysis
- Video Content Analysis
- Picture ID Output
- Cursor with Data Word Value Display

TSG 601 Handheld Serial Component Generator

- 75% color bars
- 100% color bars
- Pluge, BBC version 1
- Pluge, BBC version 2
- 5 Step staircase
- Limit ramp
- Convergence
- PLL SDI checkfield
- Equalizer SDI checkfield
- SDI checkfield matrix
- Valid (encodes to PAL or NTSC) 5 step modulated staircase
- Valid modulated pulse and bar
- 60% line sweep with markers at 0.5, 1.0, 3.0, 4.0 and 5.0 MHz
- 500 kHz reduced amplitude bowtie
- Shallow ramp, settable levels
- Active picture markers
- Programmable Embedded Audio
- Return Loss Alarm
- Passive Cable Simulator
- Character ID
- User Presets

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

SDA 601
Handheld Serial Digital Analyzer.

Opt 01 – NiCad Battery Pack.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

TSG 601
Handheld Serial Component Generator.

Opt 01 – NiCad Battery Pack.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

Generators/Inserters

TSG 170A • TSG 271

Features

- TSG 170A
- TSG 271

TSG 170A NTSC Television Generator

- Simple, effective test signal complement
- Correctly SCH phased sync pulse generator with digital genlock
- Separate SMPTE bars with programmable ID (Opt. 01)

TSG 271 PAL Television Generator

- Precise 12-Bit digitally derived test signals
- SCH phase accuracy, guaranteed by use of a single D AC
- Conforms to EBU Statements D23 and D25
- Stable internal reference, ideal for master sync operation

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(TSG 271)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

TSG 170A
NTSC Television Generator.

Opt. 01 – Adds separate SMPTE Bars Output with 12-character ID, Audio Tone Output and Tape Leader Countdown.

Opt. 1V – VM 700T Signal Set.

TSG 271
PAL Television Generator.

Opt. 01 – Character ID and Audio Tone Output.

Opt. 05 – PAL-D Signals.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. D3 – Test Data (requires Opt. C3).

Opt. D5 – Test Data (requires Opt. C5).

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

Generators/Inserters

SPG 1000 • TSG 1001 • VITS 100 • VITS 200 • VITS 201 • 1910

Features

- SPG 1000
- TSG 1001
- VITS 100
- VITS 200
- VITS 201
- 1910

SPG 1000 MULTIFORMAT HDTV Sync Generator

- Master sync generator for high definition television systems
- Sync locks to HDTV, NTSC, and PAL
- Color bars and monitor setup test signals
- Provides genlock function for TSG 1001 Generator

TSG 1001 Programmable TV Generator

- Multiformat, programmable test signal generator
- Programmable zone plate generator
- SDP 1000 Signal Development Package
- PC based software program
- Waveform editing and creation
- PC to generator test signal downloads
- Internal or external clock operation
- SMPTE/EBU, Betacam, MII, NTSC analog, NTSC composite digital, CCIR 601 component digital, and HDTV test signal libraries
- 10-Bit signal generation
- 30 MHz bandwidth
- Analog and parallel digital test signal outputs
- Battery backup for RAM signal memory
- Programmable trigger function for waveform analysis

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(SPG 1000, TSG 1001, VITS 201)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

Generators/Inserters

SPG 1000 • TSG 1001 • VITS 100 • VITS 200 • VITS 201 • 1910

VITS 201 PAL Insertion Generator

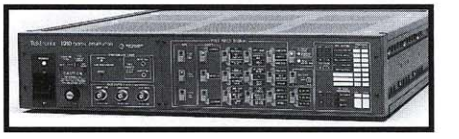
- CCIR, EBU, UK National ITS
- GCR signal
- Operates in the presence of sound in syncs
- Four external ITS inputs
- Comp Sync output
- Source identification
- All user program settings saved in non-volatile storage
- User programs for:
  - Insertion of internal, external, and source identification signals
  - Loss of program input modes

VITS 100 NTSC Generator/Inserter

- Low price generator/inserter
- NTC7, FCC, and VIR signals
- VM 700T recognizable vertical interval source identification
- Cable signal set (Opt. 02)
- Special features for PAL-M systems (Opt. 1M)

VITS 200 NTSC Generator/Inserter

- Full capability generator/inserter for use at the facility output point
- NTC7, FCC, VIRS, and GCR signals
- Four external VITS inputs
- VM 700T compatible vertical interval source identification
- Text generator for full field and vertical interval messages
- Sync and burst regeneration
- Full field test signal output
- RS-232C and ground closure remote control
- Loss of program continuity mode (standby mode)



1910 NTSC Digital Generator/Inserter

- Studio, transmitter, and transmission test signals
- 10-Bit signal generation
- RS-232C control port
- Four external VITS inputs
- Non-volatile memory to maintain selected VITS and full field signal configuration after power interruption
- Ghost Canceller Reference (GCR) signals available in standard product

Generators/Inserters

SPG 1000 • TSG 1001 • VITS 100 • VITS 200 • VITS 201 • 1910

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

When ordering, specify SPG1000 Option 15, or the SPG1000 with any three of Options 01 through 04 (for example, Options 01, 03 and 04).

SPG1000 OPTION 15
HDTV Sync Generator.
Includes: Options 01, 02, and 03.
Opt. 01 – Oscillator No. 1.
Opt. 02 – Oscillator No. 2.
Opt. 03 – Oscillator No. 3.
Opt. 04 – Oscillator No. 4.
Opt. 16 – Includes Opt. 1, 3, 4.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

TSG 1001
Programmable TV Generator.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

VITS 100
NTSC Generator/Inserter.
Opt. 02 – Cable signal set.
Opt. 1M – Special features for PAL-M systems.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

VITS 200
NTSC Generator/Inserter.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

VITS 201
PAL Insertion Generator.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

1910
NTSC Digital Generator/Inserter.
Opt. 01 – GCR signal and 0% setup test signals.
Opt. 03 – CBC test signals.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE *(SPG 1000, TSG 1001, VITS 201)*

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digital Audio Monitor

764

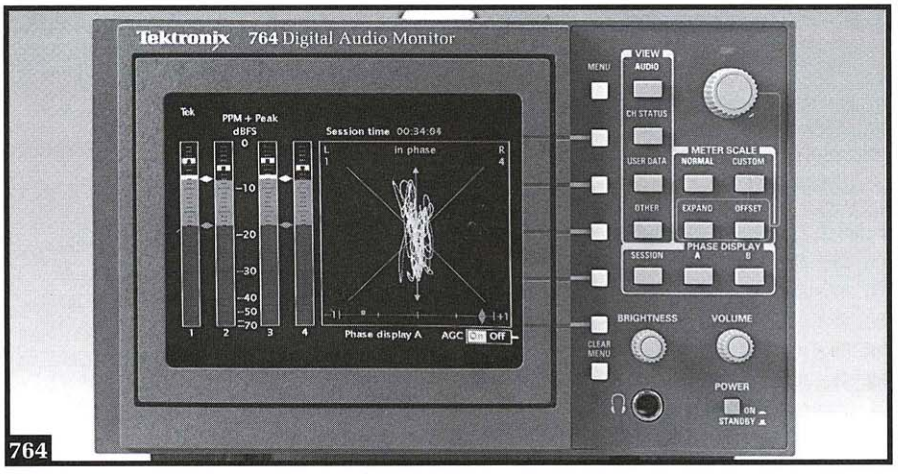
Features

764

- Two AES/EBU Input Channels with Loop-through Capabilities
- Four-channel Level Metering
- Phase Display with Correlation Meter
- Session Statistics
- Channel Status Decoding
- Optional Embedded Audio Input
- Optional Audio Line Outputs

Applications

- Consoles and Workstations
- DAT, D1, D2, D3, etc.
- Digital STL for Radio
- A/D Testing and Alignment
- Digital Audio Routers
- Signal Processing
- Duplication and Mastering
- Embedded Audio Monitoring (Optional)



764 Digital Audio Monitor

The Tektronix 764 is an advanced monitoring tool for production and quality assessment in modern digital audio facilities. It combines the features of a phase and level meter with those of a digital audio data monitor. The 764 provides technical personnel with a setup and calibration tool and production personnel with an operational monitor capable of conventional and advanced audio assessment tasks.

AUDIO LEVEL
Audio amplitude measurement results are displayed on up to four bar graphs. Most characteristics can be configured to user preferences. This includes the amplitude scale and ballistics, peak-hold characteristics and the value of test and peak levels. Other features include detection of digital clipping and muting and detection of system errors.

SESSION STATISTICS
The 764 records critical level parameters and several types of data and format errors for each session. These events/errors are time stamped with either Vertical Interval or Longitudinal Time Code to simplify their location on a digital audio workstation.

AUDIO PHASE
A Lissajous display is augmented with a mathematical phase correlation meter. In addition, selectable Sum and Difference bars provide an additional phase assessment tool.

SYSTEM TIMING
A Digital Audio Reference input, conforming to AES recommendations, permits 764 users to assess timing relationships between digital audio signals. Common problems due to sample slipping and non-locked signals can easily be detected.

CHANNEL STATUS AND USER DATA
Channel status and user data are recovered and displayed in contiguous 24-byte blocks. This allows the content and format of these auxiliary data channels to be monitored. Channel status data is decoded into English, simplifying data analysis.

EMBEDDED AUDIO INPUT (OPTION)
The 764's Embedded Audio Input option extracts digital audio from 270 Mb/s serial component signals and from 143 Mb/s serial composite signals. This option supports extraction of audio data up to 20-Bits at a 48 kHz sample.

ANALOG LINE OUTPUTS (OPTION)
Option 02 analog Line Output provides digital-to-analog conversion within the 764 for driving amplifiers/speakers. The balanced line level output can be either fixed (jumper selectable calibration settings) or variable (via the headphone Volume control). The rear-panel AES/EBU balanced output is lost when this option is installed.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

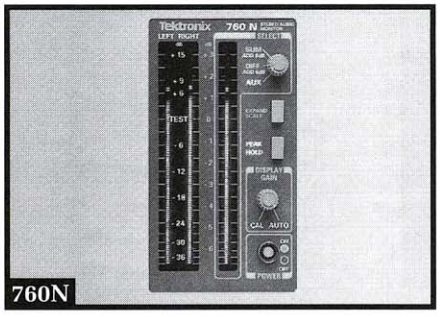
764 DIGITAL AUDIO MONITOR.
Opt. 01 – Adds Embedded Audio Input.
Opt. 02 – Adds Analog Line Outputs.

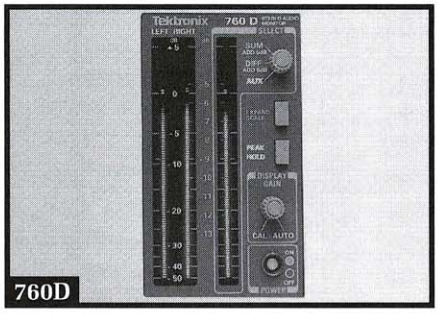
ACCESSORIES
1700F00 – Plain Case.
1700F02 – Portable Case.
1700F05 – Dual Rack Adapter.
1700F06 – Blank Panel.
1700F07 – Utility Drawer.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. R3 – Repair warranty extended to cover three years.
Opt. R5 – Repair warranty extended to cover five years.
See page 581 for further information.

Audio Monitors/Generators

760N • 760D • 760A • ASG 100 • ASG 140





With Tektronix' 760 Series Stereo Audio Monitors, the audio engineer can analyze a pattern display of the stereo audio signal. This display, along with a high resolution bar graph, provides accurate monitoring and measurement capabilities. Used in both operation and setup, the instrument provides immediate feedback of the audio signal for creative or technical correction. With the appropriate test signals, the unit can also be used for accurate phase and amplitude measurements. Three product versions are available with various scales: 760A (standard), 760N (Nordic), or 760D (DIN) (see photos).

760A Series Stereo Audio Monitor

- Graphic CRT display of stereo audio signal
- AGC for continuously viewable pattern
- Bar graph for quick setups and accurate peak indication
- Third bar indicates mono compatibility when set to L+R
- Suitable for phase and amplitude measurements
- Optional Nordic or DIN Scale
- Scale and dynamics conform to proposed IEEE ppm standard
- EXPAND SCALE feature increases resolution at –8 dB (760A) level for accurate line-ups
- White phosphor CRT option available

ASG100

- Dual channel for stereo applications
- Balanced inputs and outputs
- Connects in-line for easy test signal insertion
- Quick identification of insertion point with voice ID

ASG 140

- Four output channels
- 10 Ω output impedance
- Ideal for VTR maintenance

ASG 100/ASG 140 Common Features

- Short duration audio test sequence for rapid automatic checkout of audio lines
- Single button selection of line-up tone
- Tone, multitone, polarity and sweep signals
- Manual mode allows selection of frequency and amplitude
- Quick identification of insertion point with voice ID
- RS-232 for remote control

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

760A
Stereo Audio Monitor.

Opt. 74 – White Phosphor CRT (760 Series).

760D
Stereo Audio Monitor.

760N
Stereo Audio Monitor.

ASG 100
Audio Signal Generator.

ASG 140
Four Channel Audio Generator.

MEASUREMENT SERVICE OPTIONS

Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

Audio Analyzer
UPD04 • UPD05

Features

UPD04 • UPD05

- Compact Unit with Integrated PC
- Two-channel Measurement for Fast and Effective Stereo Measurements
- Comprehensive Range of Analysis Modes Through Built-in FFT Analyzer
- Quick and Easy Implementation of New Measuring Functions via 3.5 inch Diskette
- All Measurements with any Combination of Input and Output (AA, AD, DA, and DD)
- Flexible Application Through Almost Unlimited Range of Filters
- Extremely High Dynamic Range for Measurements on High-end Equipment
- High Measuring Accuracy and Speed
- Fast and Simple Operation

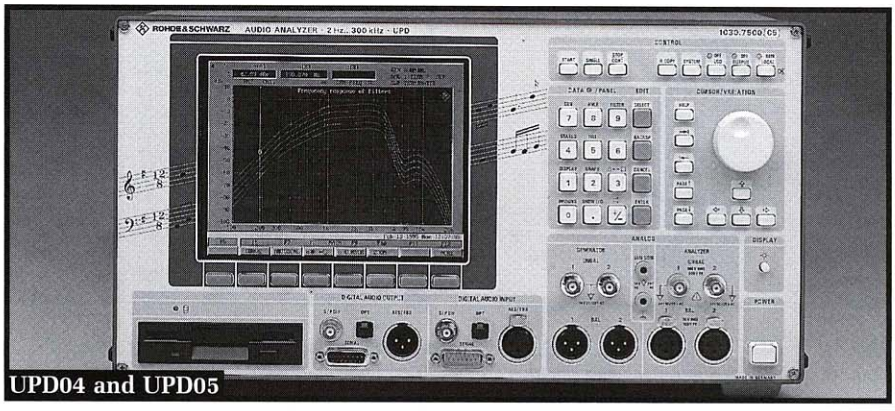
Applications

- Entertainment Electronics: DCC, Mini-discs, CD Players, Cassette Decks, Amplifiers, Tape Decks, Car Hi-fi
- Professional Studio Technology: Audio Mixers, Tape Machines, DAT Recorders, Sampling Rate Converter, Sound Processors
- Transmission Links
- Modules and Components: ADC, DAC, Equalizers.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



UPD04 and UPD05

UPD Audio Analyzer

The market for audio products gets more and more sophisticated by the day. And the demands made on measurements – from development to production and monitoring – get tougher and tougher. Analog technology has reached the limits of the physically possible, but digital technology opens a totally new dimension. What's needed is a first-class audio analyzer with digital technology, equipped to meet the full range of current analog and digital measuring tasks – open and programmable for the future. The UPD Audio Analyzer is truly a versatile state-of-the-art analyzer that can measure the best that audio technology has to offer with unbeatable accuracy.

A COMPLETE SOLUTION

The UPD Audio Analyzer is a compact, universal measuring instrument with built-in generators for measuring the full range of audio parameters at analog and digital interfaces. The UPD provides fast measurements and is equipped with all commonly used interfaces. Windowing and user prompting make the UPD easy to use despite the large number of measurement and signal generation possibilities.

The latest digital signal processing capabilities, an extensive range of analysis modes, and Fast Fourier Transform (FFT) give you peace of mind, now and for the future – the technology used in the UPD allows the implementation of new measuring functions simply by loading new or updated software.

MEASURE ANYTHING AT ANY INTERFACE

Equipped with all common interfaces, the UPD can measure just about anything. In the future, you won't need three measuring instruments – just one, the UPD. No matter what interface you have, we'll make the connection.

PROGRAMMED FOR THE FUTURE

Digital filters and signal processing mean superb accuracy and great flexibility. Since filters and signal processing are software-implemented, new features can be added easily. With other instruments, changes in testing requirements call for the purchase of new test equipment. Not with the UPD! A software update is all that's needed.

EASY TO OPERATE

Despite the wide range of functions offered, intelligent user prompting and context-sensitive help keep the UPD remarkably simple to operate. Routine measurements become truly routine – just call up settings, carry out the measurement, and generate the protocol at the press of a key. Because familiarization is so fast and easy, you save both time and costs.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

UPD04
Audio Analyzer with monochrome display.
Opt. B1 – Low Distortion Generator.
Opt. B2 – AES/EBU Interface.
Opt. B3 – High Speed Extension.
Opt. B4 – IEC-625/IEEE-488 Bus.
Opt. B5 – Audio Monitor.
Opt. B22 – Jitter and Interface Test.

UPD05
Audio Analyzer with color LCD display.
Opt. B1 – Low Distortion Generator.
Opt. B2 – AES/EBU Interface.
Opt. B3 – High Speed Extension.
Opt. B4 – IEC-625/IEEE-488 Bus.
Opt. B5 – Audio Monitor.
Opt. B22 – Jitter and Interface Test.

UPDK1
Universal Sequencer Controller Software.

RECOMMENDED ACCESSORIES
19 Inch Rack Adapter. Includes Front Handles. Order ZZA-95.

Service Manual – Order 1030.7551.24.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

Audio Measurement Set
AM700

Features

AM700

- Programmable Audio Analyzer/Generator
- Balanced Analog Audio
- Digital Audio
  - AES/EBU
  - SPDIF
  - Optical
- Manual and Automatic Measurements
- GPIB Remote Control
- Benchtop or Portable Operation

AM700 Audio Measurement Set

The Tektronix AM700 provides audio professionals operating in a mixed-signal environment a powerful tool set for design, manufacturing, quality control, installation and service applications. An intuitive user interface allows first-time users to immediately perform common tasks with accuracy and repeatability.

A totally self-contained instrument, the AM700 requires no personal computer, external display monitor or separate signal generator to stimulate and analyze audio equipment and display measurement results. This level of integration makes the AM700 a truly portable measurement system.

FFT ANALYZER
Two-channel, wideband FFT analysis has never been easier. Selecting windowing schemes, averaging and cursors is accomplished through touch-screen menus. The zoom mode provides variable frequency resolution. The AM700 can record maximums and minimums to track signal deviation over time.

PLOTTING ANALYZER
The AM700's plotting analyzer is exceptionally flexible. It provides plots of dependent parameters like level, phase and distortion against independent parameters like level and frequency. Cursors, filters, zoom and relative-to-reference add to the functionality of this two-channel analyzer.

MULTITONE ANALYZER
Real-time analysis of both user-defined multitones and standard multitones simplifies many analysis, adjustment and measurement operations. The AM700 multitone analyzer is compatible with multitone signals from the Tektronix ASG 100/140 Audio Signal Generators, the portable AM70 Digital Audio Analyzer/Generator, and generates multitones compatible with the VM 700T Video Measurement Set, as well as other popular test equipment.

MONITOR MODE
The "Waveform" provides oscilloscope displays of input, output, and residual signals like harmonic distortion. Headphone jack permits users to listen to these signals as well.

DIGITAL INTERFACE ANALYZER
Measurement and analysis of the digital signal in the analog domain is critical for ensuring that the signal conforms to technical standards. Whether troubleshooting equipment interface problems or designing interface circuitry, this analyzer provides an eye pattern display, jitter, and time-domain measurements.

AUDIO GENERATOR
For every function listed above, the internal programmable generator can produce a complimentary signal in digital or analog form (as appropriate).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

AM700
Audio Measurement Set.
Opt. 1F – Adds ASW100F Switcher.
Opt. 1M – Adds ASW100M Switcher.
Opt. 1P – Adds Epson Serial Printer.

ACCESSORIES
AM7FR1 – Rackmount Kit.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.
Opt. C5 – Five years of Calibration Services.
Opt. D3 – Test Data (requires Opt. C3).
Opt. D5 – Test Data (requires Opt. C5).
See page 581 for further information.

Audio Analyzer
New UPL

Features

- Analog and Digital Interfaces
- High-speed, Two-channel Measurements
- Maximum Dynamic Range
- Simple Automation
- Freely Programmable Filters
- Comprehensive Measurement Suite
- Fast, Flexible FFT Analysis to 110 kHz
- Jitter and Digital Interface Analysis
- Compact Unit with Integrated PC
- Extensive On-line Help

Applications

- High Throughput Manufacturing Test
- Transmission Link Test
- Equipment Maintenance
- Product Design
- Vibration/General FFT Analysis

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ROHDE&SCHWARZ

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

UPL Audio Analyzer.

The UPL Audio Analyzer performs practically all types of analog and digital measurements, from frequency response to digital interface jitter spectrum analysis.

The UPL performs all measurements using digital signal processing. Analog signals undergo elaborate preprocessing before they are digitized and measured by means of DSP-based routines. For example, in THD measurements, the fundamental is attenuated by means of a notch filter and the residual signal amplified by 30 dB before it is digitized. In this way, the UPL's dynamic range can be extended beyond that offered by its internal 20-Bit converter. This provides the dynamic range required for measuring today's state-of-the-art conversion devices. In the analog domain, this measurement concept offers many advantages over a strictly analog measurement device.

- The test routines performed on analog and digital interfaces are identical. This allows, for example, direct comparison of IMD measurements made ahead of and after a converter.
- All test functions are available both on the analog and the digital interfaces. This makes it possible to measure at any point of a common analog and digital transmission path. This ensures efficient, complete and *consistent* testing.
- Filters, too, are implemented digitally, resulting in an infinite number of possible filters. Plus, identical filters are used for measurements on analog and digital signals.
- For intermodulation measurements, spurious components are measured selectively for all frequencies in accordance with the mathematical formula of the relevant test standards. This procedure avoids the measurement of adjacent components along with the spuria, which is inevitable with analog test methods.
- Measurement speed is typically higher than with analog techniques since digital test routines can adapt their speed to the input frequency.
- Operation is the same for the analog and the digital interfaces, a feature that should not be underestimated.

In addition to standard audio measurement capabilities, the UPL contains a powerful and flexible FFT analyzer. FFT sizes from 256 to 8K points combined with zoom factors up to 128 provide a wide range of performance, from near-real-time speeds to pinpoint resolutions (down to 0.05 Hz!).

When testing digital audio interfaces (option B2), the UPL's balanced (XLR), unbalanced (BNC) and optical (TOSLINK) inputs and outputs allow easy connection to both consumer electronics and professional studio equipment. A reference (XLR) and a synchronization (BNC) input provided on the rear panel allow both the analyzer and the generator to be synchronized to the digital audio reference signal (DARS according to AES 11), to word-clock, video sync signals (PAL, SECAM, NTSC) and to 1024 kHz reference clocks.

Digital protocol analysis and generation (option B21) offers indepth testing of channel status and user data. Channel status data is evaluated in the professional or consumer format to AES 3 or IEC 958.

Jitter and interface test (option B22) examines the physical parameters of digital audio interfaces, including time and phase differences, jitter spectrum and demodulated waveform displays, and more.

With the Automatic Sequence Controller (option B10), automated test routines can be built by a keystroke logging capability, drastically reducing the time required to generate programs.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

UPL AUDIO ANALYZER

Opt. B1 – Adds Low Distortion 110 kHz Analog Oscillator.
Opt. B2 – Adds Digital I/O Capability.
Opt. B4 – Adds IEEE/RS-232 Remote Control Capability.
Opt. B5 – Adds Headphone Output and Internal Speaker.
Opt. B10 – Adds Automatic Sequence Controller.
Opt. B21 – Adds Protocol Analysis Capability.
Opt. B22 – Adds Jitter and Interface Test Capability.
Opt. Z1 – Adds XLR-to-BNC Adapter Set.
Opt. 1R – 19 in. Rack Adapter

MEASUREMENT SERVICE OPTIONS

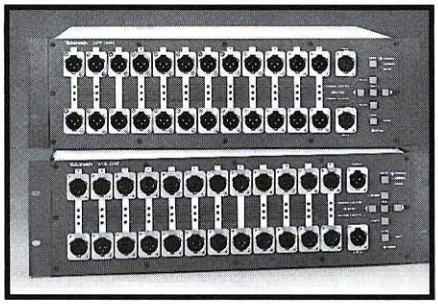
Call your local Tektronix representative for a full list of service options.

Audio Switchers, Digital Audio Analyzer

ASW100M • ASW100F • AM70

Features

- ASW100M
- ASW100F
- AM70



ASW100M Output Switcher
ASW100F Input Switcher

The Tektronix ASW100 Measurement Grade Audio Switchers permit the inputs and outputs of analog audio test equipment to be switched between multiple signal sources and destinations. ASW100 instructions contribute no measurable degradation to signals under test.

- Balanced signal paths
- Manual controls
- RS-232 and GPIB operation
- Cascadable
- Cable shield lifts
- Universal power supply
- Rackmount

Calibration and Testing of Audio Equipment

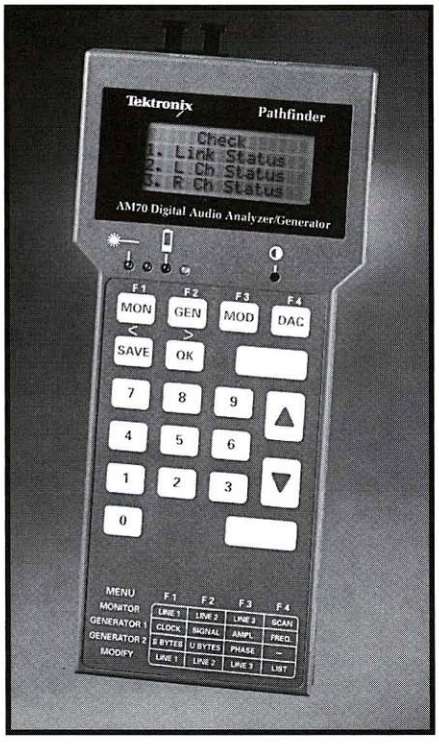
- Multitrack tape decks
- Mixing consoles
- Surround sound gear

Monitoring Multiple Devices Under Test

- Burn-in test chamber
- Powered life testing

Routing Ultrasonic Signals

- BTSC baseband signals
- RDS-modulated signals
- SCA-modulated signals



AM70 Handheld Digital Audio Analyzer/Generator

- Balanced analog outputs
- Balanced/unbalanced digital inputs and outputs
- Optical inputs and outputs
- Internal speaker/headphone jack
- Battery powered

Installation and Troubleshooting

- Signal tracing in analog and digital domains
- Confidence monitoring of digital audio signals

Digital Compatibility Debug

- Resolving data compatibility problems
- Digital audio format conversion

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

ASW100M
Output Switcher.

ASW100F
Input Switcher.

AM70
Handheld Digital Audio Analyzer/Generator.

Opt. 01 – NiCad Battery Pack.

MEASUREMENT SERVICE OPTIONS

Opt. C3 (AM70 only) – Three years of Calibration Services.

Opt. C5 (AM70 only) – Five years of Calibration Services.

Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

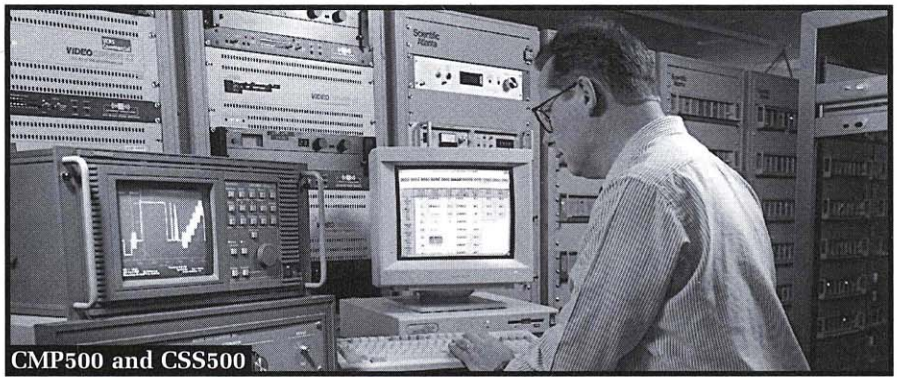
See page 581 for further information.

RF/Cable Measurement Packages

CMP500 • CSS500

Features

- CMP500
- CSS500



CMP500 and CSS500

CMP500 Cable Television Measurement Package/CSS500 Cable Television System Software

- Delivers baseband video and RF measurement performance unmatched in the industry
- Performs all recommended baseband and RF measurements including the FCC requirements
- Includes easy-to-use Windows-based control software
- Automatically monitors results and displays alarm when out-of-service measurement limits are reached
- Sequences can be defined on the computer, downloaded to the 2714, which can be removed from the system to make automatic field RF measurements
- Displays the picture of the channel being measured on the computer screen when equipped with video display board
- Compatible with standard, HCR or IRC systems up to 1 GHz
- Export data to Windows-based programs such as Lotus 1-2-3 or Microsoft Excel for more detailed analysis
- Supports many different types of printers

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

CMP500 Cable Measurement Package.

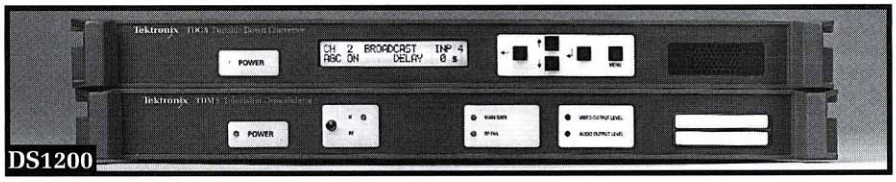
CSS500 Cable Measurement Package Software.

Television Demodulators

DS1200 • TV1350

Features

- DS1200
- TV1350



DS1200 Low Cost Television Demodulator System

- Low cost
- Measurement quality performance
- 47 MHz to 860 MHz frequency range
- Cable TV standard, HRC and VHF/UHF channel tables
- RS-232C or RS-485 control of TDC5 Tunable Down Converter
- Synchronous detection
- Gain control system optimizes signal-to-noise ratio and intermodulation distortion
- Zero carrier pulse for depth of modulation measurement
- Wide dynamic range
- Four RF inputs on TDC5
- Quadrature out for ICPM measurements
- Aural intercarrier out for interface to a BTSC decoder

TV1350 Series Television Demodulators

- Continuously tunable over all TV bands (with Opt. 01) and CATV channels (HRC and IRC) to 880 MHz (channels 2-99) with synthesizer precision for HRC and IRC
- Channel selection by digital entry of channel number, manual or remote modes, plus search
- Automatic compensation for carrier offsets to ±100 kHz
- Switch selectable sound trap
- Switchable IF gain for improved S/N ratio
- Selectable envelope or synchronous detection
- Synchronous detector quadrature output for convenient adjustment of modulation balance and ICPM measurements
- Stable zero carrier reference for video level adjustments and residual carrier measurements
- Built-in loudspeaker, headphone jack, and deviation meter
- Parallel remote control standard; IEEE 488 bus interface optional
- User-friendly operation
- Available in standards M, D/K, B/G, I, and K1
- Worldwide audio standards available: dual sound, NICAM prepared, or BTSC output

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

For complete ordering information for your country, please contact your local Tektronix representative.

DS1200
Demodulator System.

MEASUREMENT SERVICE OPTIONS
Call your local Tektronix representative for a full list of service options.

TV1350
Demodulator.

MEASUREMENT SERVICE OPTIONS
Opt. R3 – Repair warranty extended to cover three years.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

Television Demodulator
DS 1001

Features

DS 1001

- Supports Standard M/N
- Tuning Range from 55.25 to 801.25 MHz (M/N)
- Stereo Sound: BTSC
- Zero Carrier Pulse for Depth of Modulation Measurements
- Intercarrier Output for Using an External Audio Demodulator or Modulation Monitor
- Synchronous Detection for Phase-sensitive Measurements
- Quadrature Output for ICPM Measurement
- User-defined Channel Table
- 20 User-defined Programs
- RS-232/RS485 I/O Port for Remote Control

DS 1001

DS 1001

The Tektronix DS 1001 Television Demodulator is the answer to cable operators, broadcasters, and manufacturers that need a low-cost, high-performance demodulator. It supports television standard M/N.

The DS 1001 is a full measurement-grade demodulator, with specifications better than demodulators twice its size. Input sensitivity and return loss specifications make the DS 1001 ideal for use as a repeater or as the analog front end of an RF-to-digital conversion system in all-digital cable systems. It can also act as a precision set-top converter for making baseband measurements in the field.

The DS 1001 is well suited for remote node monitoring. The addressable serial port allows remote control and status monitoring using computers and modems.

The DS 1001 shares the same physical package as the VM100/101 Video Measurement Set. The two can be mounted side by side taking only 46 mm (1.75 inches) of rack height. For a complete solution that includes a graphical display, the DS 1001 can be combined with the 1740A Combination Waveform/Vector Monitor. In addition to the rackmount solutions, the DS 1001 can be added to the VM140/141 Video Measurement Package to test baseband signals in the field.

AUDIO SUPPORT

Audio support includes BTSC stereo for system M/N. Audio output is through two XLR connectors. These connectors can have several possible configurations including: mono, SAP, and stereo right and left. The DS 1001 has a 4.5 MHz intercarrier output for driving an external modulation monitor.

REMOTE PROGRAMMING

The DS 1001 supports remote programming via either RS-232 or RS485 at 9600 baud. Most front-panel controls can be accessed via the port. Details on the command set are included in the user's manual.

Characteristics

RF SECTION

RF Tuning Range – 55.25 to 801.25 MHz.

RF Sensitivity – 0 to +30 dBmV.

Return Loss – >6 dB.

Input Impedance – 75 Ω.

Input Connector – Female "F".

Channel Tables – User configurable.

IF SECTION

Visual IF Frequency – 45.75 MHz.

Aural IF Frequency – 41.25 MHz.

IF Output – +51 dBmV (typical), BNC.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Television Demodulator

DS 1001

VIDEO SECTION

Video Output – One BNC connector.

4.5 MHz Intercarrier Output – One BNC connector.

Video Signal – 1 V_{p-p} baseband video.

Video Signal-to-Noise – >50 dB (NTC7-weighted).

Quadrature Output – 1 V_{p-p} 90° phase of the Video Signal, BNC.

Frequency Response (18° C to 26° C) – ±0.7 dB 100 kHz to 3.58 MHz. ±2 dB 3.58 MHz to 4.1 MHz.

Group Delay (post correction off) – ±50 ns, 100 kHz to 3.58 MHz.

Differential Gain – <1.5%.

Differential Phase – ±1.5°.

Chroma/Luma Delay – <40 ns.

Luminance Bar Amplitude – <2%.

Luminance Bar Tilt – <3%, 2% typical.

2T K Factor – <2.5% typical.

Line Time Distortion – <3%, 2% typical.

AUDIO SPECIFICATIONS

Audio Outputs – 2 ea. XLR configurable (LEFT/RIGHT, MONO/SAP, MONO/MONO).

Level – 0 dBm across 600 Ω.

Frequency Response – ±0.5 dB, 50 Hz to 12 kHz (typical).

THD – <1% at 1 kHz (video sync only).

ENVIRONMENTAL SPECIFICATIONS

Temperature –
Operating: +5 to +35° C.
Non-operating: –20 to +75° C.

Altitude –
Operating: 0 to 6,500 ft. (1,981 m).
Non-operating: 0 to 50,000 ft. (4,572 m).

POWER

Source Power –
Voltage Range: 95 to 240 VAC.
Line Frequency: 50/60 Hz.

Power Consumption – 30 VA maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	46	1.8
Width	206	8.1
Depth	440	17.3
Weight	**kg**	**lbs.**
Net	2.2	4.8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DS 1001 M/N TELEVISION DEMODULATOR
Includes: User's Manual, Power Cord.

INTERNATIONAL POWER CORD OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz.
Opt. A2 – UK 240 V, 50 Hz.
Opt. A3 – Australian 240 V, 50 Hz.
Opt. A4 – North American 240 V, 60 Hz.
Opt. A5 – Switzerland 220 V, 50 Hz.

RECOMMENDED ACCESSORIES

TVGF11A – Rackmount Single DS 1001 in a 483 mm (19-in.) Rack.

TVGF13 – Rackmount Two Half-rack Instruments Side-by-Side in a 483 mm (19-in.) Rack. (Use to combine DS 1001 and VM100).

TVGF14 – Rackmount Two Half-rack Instruments Vertically in a 19-in. Rack. (Use to combine DS 1001 with a VM100 and a 1700 Series Monitor).

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SignalScout™ Signal Level Meter
RFM150

Features

- 5 MHz to 1 GHz Frequency Range
- Guaranteed ±1 dB Accuracy Over Wide Temperature Range
- In-service Carrier-to-Noise Measurement
- In-service Hum Measurement
- FM Deviation Measurement
- Multiple Level Modes
- Channel Spectrum Display
- Multi-format Compatible – NTSC, PAL, SECAM, Digital Carriers
- Reference Sweep with up to Eight References
- Local Storage of Measurement Results
- Easy-to-use – Most Selections Require Two Keystrokes or Less. Numeric Keypad Simplifies Channel or Frequency Selections.
- Interface Port for Uploading Test Results to a PC, Downloading Test Sequences and Configuration to the RFM150, and Printing Directly to a Printer
- Internal Timer Function for FCC 24-Hour Testing and Other Time-specific Testing
- NICAM and Dual Aural Carrier Compatible
- Powerful Windows-based CSS150 Software Available to Control and Display Measurements
- FM Detector and Speaker
- Durable and Weather-resistant
- Three-year Parts and Labor Warranty
- CE Marking

RFM150 SignalScout Signal Level Meter

The RFM150 SignalScout is a high-performance RF signal level meter designed to meet the demanding requirements of cable TV applications.

THREE-YEAR LIMITED WARRANTY
SignalScout is protected under Tektronix Warranty 4 covering parts and labor for a period of three years. Specifics on Warranty 4 can be obtained directly from Tektronix or its subsidiaries.

RUGGED DESIGN
The rugged mechanical construction using high impact material and an internal shock system provide excellent resistance to damage. The included padded carrying case protects SignalScout during transport, yet allows use of all functions while still in the case. The weather-tight construction guarantees operation in varying weather conditions.

Characteristics

RF INPUT
Input Impedance – 75 Ω.

Return Loss – >14 dB, 20 MHz to 1080 MHz. >8 dB, 5 MHz to 20 MHz.

Connector Type – Replaceable F.

FREQUENCY
Range – 5 MHz to 1080 MHz.

CARRIER LEVEL MEASUREMENTS
±1 dB –20 dBmV to +60 dBmV, (0°C to +50°C) Max; ±1.5 dB –35 dBmV to –20 dBmV, (–10° C to +50° C) T&P. (Typical for 5 MHz to 20 MHz).

CARRIER-TO-NOISE RATIO
Accuracy – ±2 dB (0°C to +50°C) Max; ±2 dB (–10°C to +50°C) Typical.

Repeatability – ±1 dB.

Range – Up to 48 dB (50 dB typical) for carrier amplitudes ≥0 dBmV (+60 dBµV) and for carrier frequencies ≥50 MHz. No external pre-selector or external preamp is required to meet the C/N range and accuracy specification.

Audio Compatibility – With NICAM, C/N measurement accuracy is guaranteed for out-of-service measurements only.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SignalScout™ Signal Level Meter

New RFM150

HUM
Accuracy – ±1% (0°C to +50°C) Max; ±1% (–10°C to +50°C) Typical.

Repeatability – ±0.5%.

Range – 1% to 5%.

AVERAGE POWER (DIGITALLY MODULATED CARRIERS)
Accuracy – ±1 dB (0° C to +50° C) Max; ±1 dB (–10° C to +50° C) Typical.

Repeatability – ±0.5 dB.

SPECTRUM MODE
Dynamic Range – 50 dB.

Reference Level Range – 0 dBmV to +60 dBmV (+60 dBµV to +120 dBµV).

Reference Level Resolution – 1 dB steps.

Spurious Free Dynamic Range – –50 dBc (20 MHz to 1 GHz) –45 dBc (5 MHz to 20 MHz).

Marker Amplitude Accuracy – ±1 dB for signals in the upper half of the display.

General Characteristics

ENVIRONMENTAL
Temperature –
Operating: 0°C to +50°C (+32°F to +122°F).
Non-operating: –20°C to +60°C (–4°F to +140°F).

Humidity – 5% to 95% from 0°C to +50°C.

Altitude –
Operating: 15,000 ft. (4,550 meters).
Non-operating: 50,000 ft. (15,167 meters).

Vibration – Resonate searches of 0.020 in. (0.508 mm) on all three axes for 5 minutes per axis. Dwell for 10 minutes per axis at major resonance or 33 Hz if none found. Total vibration time is 45 minutes.

Shock – Three drops of 50 g on each face, 11 ms duration, half-sine pulse shape. Eighteen drops total.

POWER
Battery Life – 3.5 hours typical.

DC Input Range – 11 to 16 VDC.

Maximum Input Current – 1.0 A at 12 VDC supplied by external adapter or vehicle adapter.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	280	11
Width	200	8
Depth	90	4
Weight	**kg**	**lbs.**
Net	3.6	<8

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

RFM150
SignalScout Signal Level Meter.
Includes: Instruction Manual (070-9006-00), Quick Operation Manual (070-9002-00), 120 VAC Power Pack (119-4855-00), Precision Female-Female Type-F Adapter (103-0301-00), RS-232C DB-9 Male-Female Cable Assembly, Padded Carrying Case (016-1345-00), Vehicle Adapter (119-4860-00), CSS Software (070-0112-00).

Opt. 01 – Additional non-volatile memory (adds 128 K of NVRAM).

Opt. A1 – Universal Euro 220 VAC Power Pack.

Opt. A2 – UK 220 VAC Power Pack.

Opt. A3 – Australian 220 VAC Power Pack.

Opt. A6 – Japan 120 VAC Power Pack.

MEASUREMENT SERVICE OPTIONS
Opt. C3 – Three years of Calibration Services.

Opt. C5 – Five years of Calibration Services.

Opt. R5 – Repair warranty extended to cover five years.

See page 581 for further information.

OPTIONAL ACCESSORIES
Precision BNC to F-Series Adapter – Order 103-0310-00.

Opt. 03 – Thermal Printer. Order HC411.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Video Transmitter
New DVT200

Features

DVT200

- Provides Both DVB-C and DVB-S Test Signals
- 1 MHz to 3.3 GHz Frequency Range
- QPSK and 16, 32, 64, 128, or 256 QAM Modulation
- Parallel MPEG2 Transport Stream and External I/Q Input
- Locks To MTS Data Rates Between 2 and 60 Mbit/s
- Internal Data Rates Selectable Between 2 and 60 Mbit/s
- Automatic Switching to Internal PRBS at Loss of MTS
- Wide Output Level Range: –100 dBm to +4 dBm
- Selectable Modulation Impairments for Stressing Receiver Designs
- Selectable Pulse Roll-off Factors and Puncturing Rates
- Energy Dispersal, Interleaving, and Reed-Solomon Coder can be Individually Enabled
- Null TS Packet Generation
- Meets DVB specifications to ETSI 300421 (DVB-S) and ETSI 300429 (DVB-C)

Applications

- DVB-S and DVB-C Receiver Design and Manufacturing Test
- Receiver Performance Evaluation
- Reference Signals for Network Evaluation

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEC 625.1/IEEE 488.2 and SCPI 1995.0.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

DVT200 Digital Video Transmitter

The DVT200 Digital Video Transmitter is the ideal tool for evaluating the performance of DVB-compatible receivers. Its 1 MHz to 3.3 GHz frequency range and error-protected QPSK or QAM modulated signals allow testing of both DVB-C cable receivers and DVB-S satellite receivers with one product. The DVT200 provides both I/Q and MPEG2 inputs for maximum flexibility.

An important capability for receiver evaluation is the ability to add modulation impairments to transmitted signals. Adjustments for adding I/Q amplitude imbalance, carrier suppression, and I/Q phase error allow a receiver's sensitivity to these common impairments to be determined during product design or purchase evaluation.

To maintain signal modulation during the loss of an MPEG input stream, the DVT200 can automatically switch to an internal pseudo-random bit stream (PRBS) generator and maintain constant delivery of a digitally modulated, error protected MPEG transport stream (MTS). When the MPEG input is restored, the DVT200 will switch out the PRBS and resume use of the MPEG input for I/Q coding and modulation.

To address the flexibility required in product development, the DVT200 allows user control of key functional blocks and signal parameters. Energy dispersal, interleaving, and Reed-Solomon coding can be turned on or off individually. Pulse shaping can be changed by selecting square root cosine roll-off factors. For QPSK modulation, the puncturing rate can be selected to evaluate tradeoffs between error recovery and data rate. The DVT200's wide range of output levels, –100 dBm to +4 dBm, allows test signal levels to match operating conditions of many stages within a receiver and perform sensitivity measurements.

For production test or design, the DVT200 can modulate MPEG2 data streams sourced from live programming or be connected to either the MTG200 or MTS100 to produce repeatable signals for comparative testing.

Instrument setups can be stored either internally in non-volatile RAM or to a PC memory card.

Characteristics

MAIN CARRIER FREQUENCY
Range – 1 MHz to 3.3 GHz.

Resolution – 1 Hz.

REFERENCE FREQUENCY
Aging –
(after 30 days of operation) ±1 ppm/year.

Temperature Effect – (0 to +55° C) ±2 ppm.

Reference Output –
Frequency: 10 MHz.
Level (sinewave): 1 V_{RMS}.

Reference Input –
Frequency: 5 or 10 MHz.
Permissible Frequency Drift: ±3 ppm.

SPECTRAL PURITY
Spurious Signals –
Harmonics (up to 5 GHz): <–30 dBc.
Non-harmonics, CW: <–70 dBc.
Non-harmonics, I/Q (referenced to CW): <–56 dBc.

Single Sideband Phase Noise – (offset from carrier 20 kHz, 1 Hz BW) <–108 dBc.

Digital Video Transmitter

New DVT200

Spurious FM – (RMS, f = 1 GHz) 0.3 to 3 kHz (CCITT): <8 Hz.

LEVEL

Range –
CW: –99.9 to +13 dBm.
I/Q, digital modulation: –99.9 to +4 dBm.

Resolution – 0.1 dB.

Total Level Error – <±1.5 dB.

Frequency Response at 0 dBm – <+1 dB (<±0.5 dB typical).

OUTPUT

Characteristic Impedance – 50 Ω.

Connector – Front-panel Type N, female.

VSWR –
RF Level +13 to 0 dBm: <2.
RF level <0 to –99.9 dBm: <1.4.

Overvoltage Protection – Resettable signal path interrupt protects against externally fed RF power.
DC block to 50 VDC.

I/Q MODULATION

Modulation Frequency Response –
DVB-C (up to 7 Ms/s):
DC to 3.5 MHz (RF 0.3 to 1000 MHz): <±0.2 dB.
DVB-S (up to 35 Ms/s):
DC to 17.5 MHz (RF 0.3 to 3300 MHz): <±0.8 dB.
DVB-S (up to 45 Ms/s):
DC to 22.5 MHz (RF 0.3 to 3300 MHz): <±1.0 dB.

Signal-to-Noise (S/N) Ratio –
(QAM, 6.9 Ms/s, roll-off = 0.15, measured with DDS200) >35 dB.

Residual Carrier –
(at Input Voltage of 0 V, 50 Ω I/Q source, referred to full range) <–50 dBc.

I/Q Amplitude Imbalance – <1%.

Quadrature Offset (phase error) – <1°.

External I and Q Inputs –
Input Resistance: 50 Ω.
Connector: Rear-panel BNC (2).
VSWR (DC to 30 MHz): <1.4.
Input Voltage for Full Range (1 V EMF, 50 Ω): $(I^2 + Q^2)^{1/2} = 0.5$ V.

I/Q IMPAIRMENTS

Carrier Suppression –
Range: 0 to 50%.
Resolution: 0.1%.

Amplitude Imbalance –
Range: –25 to +25%.
Resolution: 0.1%.

Phase Error (Quadrature Offset) –
Range: –10° to +10°.
Resolution: 0.1°.

MODULATION SIGNALS

MPEG Input –
Type: Synchronous parallel MPEG2 TS (LVDS, to DVB-A010).
Connector: Rear-panel 25-Pin female, shielded.
Input Resistance: 100 Ω.
Input Data Rate: 2 to 60 Mbit/s.

Internal PRBS Generator –
Data Rate: 2 to 60 Mbit/s settable.
Sequence Length: $2^{23} - 1$ (to CCITT Rec. O.151).
Mode: Continuous or upon loss of MPEG stream.

Internal NULL Packet Generator –
Data Rate: 2 to 60 Mbit/s settable (conforms to null transport packets as defined in DVB measurement guidelines).

QPSK Encoder –
Compliance: ETSI 300421 (DVB-S).
Symbol Rate: 2 to 45 Ms/s.
Energy Dispersal: On/off.
Sync Inversion: To standard.
Reed-Solomon Encoder (204, 188, t = 8): On/off.
Convolutional Interleaver: On/off.
Convolutional Encoder: To standard.
Pulse Filtering: 0.25, 0.3, 0.35, 0.4, 0.45 roll-off.
Puncturing Rate: 1/2, 2/3, 3/4, 5/6, 7/8.

QAM Encoder –
Compliance: ETSI 300429 (DVB-C).
Symbol Rate: 1.5 to 7 Ms/s.
Energy Dispersal: On/off.
Sync Inversion: To standard.
Reed-Solomon Encoder (204, 188, t = 8): On/off.
Convolutional Interleaver: On/off.
Convolutional Encoder: To standard.
Differential Encoding: To standard.
Pulse Filtering: 0.1, 0.125, 0.15, 0.175, 0.2 roll-off.
Mapping: 16, 32, 64, 128, 256 QAM.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	460	18.1
Weight	**kg**	**lbs.**
Net	17.5	38.6

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DVT200
Digital Video Transmitter.
Includes: Power Cord, Operating Manual.

DVT200 OPTIONS
Opt. 1R – Rackmount Kit.

RECOMMENDED ACCESSORIES

Rackmount Adapter for 19 in. Rack –
Order ZZA-941.

WARRANTY
One year, covering all labor and parts.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEC 625.1/IEEE 488.2 and SCPI 1995.0.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digital Demodulation System
New DDS200

Features

DDS200

- Real-time Demodulation of DVB-C Signals into MPEG Transport Stream (MTS)
- 47 to 862 MHz Tunable Frequency Range
- 4 QAM to 256 QAM
- 1.5 to 7 Mbaud Symbol Rate with Auto Search Mode for Unknown Signals
- Constellation Diagrams
- BER, MER, S/N, C/I Measurements
- MTS Error Counter
- Event/condition Alarms with Settable Thresholds for Continuous Monitoring
- I/Q Modulation Error Measurements
- Carrier Suppression Measurement
- Adaptive Equalizer
- Internal Noise Generator for DVB Noise Margin Measurements
- Simple User-friendly Hardkey and Softkey Control

Applications

- DVB-C Signal Demodulation
- DVB-C Modulator Testing
- DVB-C Signal Quality Monitoring
- Determine Error Rate Sensitivity To Incremental Noise

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEC 625.1/IEEE 488.2 and SCPI 1995.0.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

DDS200 Digital Demodulation System

The DDS200 Digital Demodulation System is an essential tool for evaluating DVB-C signals and modulation equipment. The DDS200 is both a demodulator and a modulation analyzer. As a demodulator, the DDS200 processes DVB-C signals to provide continuous output of the encoded MPEG transport stream. As a modulation analyzer, the DDS200 provides a robust suite of functions to determine QAM modulation quality, transport degradation, and correctable and uncorrectable MPEG2 transport stream (MTS) errors. For continuous monitoring, the DDS200 provides programmable limits, alarms, and event logging for key parameters such as input level, frame synchronization, BER, and MTS data error.

QAM MODULATION QUALITY

The DDS200 provides constellation diagrams with fast update rates for quick visual assessment of key modulation parameters. A hold feature allows occasional stray symbols to be captured and the cumulative range of symbol errors to be assessed. High-speed signal processing provides rapid, quantitative information on I/Q amplitude imbalance, I/Q phase error, and carrier suppression. Modulation error ratio (MER) provides a quantitative measure of the overall peak or mean deviation of I/Q values from ideal signal states. This provides a one number reference to overall signal quality that is consistent with DVB specifications.

TRANSMISSION DEGRADATION

To help characterize the quality of the transmission path, the DDS200 uses its adaptive equalizer information to calculate the shift in gain and phase needed to produce the best possible input signal. That information is presented as the gain and phase curves needed to compensate for an imperfect transmission path. The same equalizer information is used to calculate and display pre- and post-echo. From the constellation diagram, the DDS200 can estimate the signal-to-noise ratio and sinusoidal interferer (C/I). Noise margin is another key measurement that can be made using the DDS200's built-in noise generator. By quantitatively adding noise to the input signal until a target BER is reached, you can determine how much incremental noise the signal can endure before transmission continuity is threatened.

MPEG ANALYSIS

To help identify the impact of transmission problems, the DDS200 monitors both the number of uncorrectable MPEG frames or the number of corrected bytes within a specified time. It also identifies synchronization errors. A 1000 item event logger keeps track of when errors occur and a statistics function tells you what percentage of the monitoring time contained errors.

To decode a program in the MTS stream, or for further analysis, the DDS200's output can be sent to an MTD200 or MTS100.

Digital Demodulation System

New DDS200

Characteristics

RF CHARACTERISTICS

Frequency Range – 47 to 862 MHz.

Input –
Level: 100 µV to 700 mV (40 to 117 dBµV).
Impedance: 75 Ω.
Connector: Front- or rear-panel BNC, female.

Channel Bandwidth – 8 MHz.

IF CHARACTERISTICS

Input –
Level: 10 to 100 mV (80 to 100 dBµV).
Impedance: 50 Ω.

Output –
Level: 45 mV (93 dBµV).
Impedance: 50 Ω.

DEMODULATOR CHARACTERISTICS

Modulation Modes –
4, 16, 32, 64, 128, and 256 QAM.

Pulse Response Roll-off Factors (selectable) – 0.15, 0.20, 0.25, 0.30.

Insertion Loss (64 QAM) – ≤1.5 dB.

Symbol Rate – 1.5 to 7 MBaud.

Equalizer – Self-adapting, selectable, with freeze mode.

Reed-Solomon Decoder – 204, 188, t = 8, selectable.

Bit Error Rate Measurement Range – 10^{-3} to 10^{-10}.

Interleaving – Interleaver (Forney), L = 12.

Energy Dispersal – IESS 309 to DVB specification.

INTERNAL NOISE GENERATOR

S/N ratio (selectable) – 12 to 62 dB.

Resolution – 0.1 dB.

Filter Selection – Automatic conversion and correct setting of S/N ratio based on selected filter.

OUTPUTS

Parallel MPEG Transport Stream –
Standard: LVDS (188 or 204 bytes).
Connector: Rear-panel 25-Pin connector.

Serial MPEG Transport Stream –
Standard: ASI.
Connector: Rear-panel 75 Ω BNC, female.

QAM Serial Data Output (before Reed-Solomon) –
Connector: Rear-panel 75 Ω BNC, female.

QAM Serial Data Clock –
Connector: Rear-panel 75 Ω BNC, female.

MEASUREMENT DISPLAYS

Graphic – Constellation display.

Calculated –
Bit error rate (BER).
Frequency offset.
Level.
I/Q phase error in degrees.
I/Q amplitude imbalance in %.
Residual carrier in dB.
Sinusoidal interference (C/I) in dB.
Signal/noise ratio (SNR) in dB.
Phase jitter in degrees.
Modulation Error Ratio (MER) as RMS or peak value.

Synchronization Information –
Symbol rate
Carrier recovery
Equalizer
MPEG2 frame

ENVIRONMENTAL CHARACTERISTICS

Temperature Range –
Operating: 0°C to +50°C.
Rated Range: +5°C to +45°C.
Storage: –40°C to +70°C.

POWER

Line Voltage (automatic range selection) –
100 to 120 VAC, +10/–15%.
220 to 240 VAC, +10/–15%.

Line Frequency – 50 to 60 Hz.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	147	5.8
Width	450	17.7
Depth	460	18.1
Weight	**kg**	**lbs.**
Net	12	26.5

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

DDS200
Digital Demodulation System.
Includes: Power Cord, Operating Manual.

DDS200 OPTIONS
Opt. 1R – Rackmount Kit.

RECOMMENDED ACCESSORIES
Rackmount Adapter for 19 in. Rack –
Order ZZA-931.

WARRANTY
One year, covering all labor and parts.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

GPIB IEEE-488 *Product(s) complies with IEC 625.1/IEEE 488.2 and SCPI 1995.0.*

See Tektronix on the World Wide Web: http://www.tek.com

CE

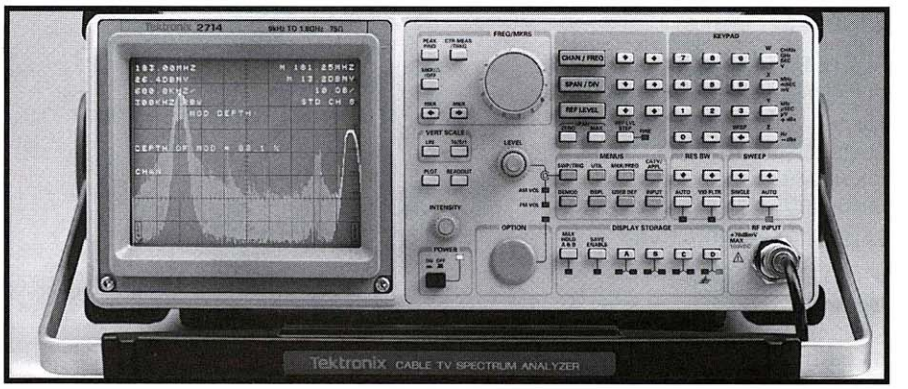
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION *Tektronix Measurement products are manufactured in ISO registered facilities.*

Spectrum Analyzer/Monitor

2714 • 1705A • 2721A • 2722A

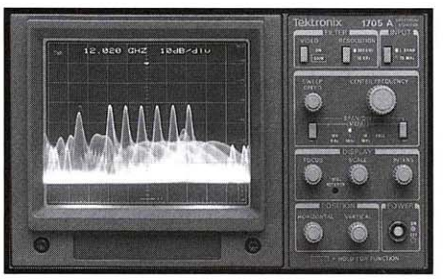
Features

- 2714
- 2721A/2722A
- 1705A
- 2715 see page 188



2714 Cable TV Spectrum Analyzer

- Automatic positioning of visual and aural carriers
- Visual and aural carrier levels and frequencies for selected channels
- Survey of system visual and aural carrier levels and frequencies
- Depth of modulation
- Aural carrier deviation measurement
- Visual carrier-to-noise measurement
- Visual to carrier amplitude and frequency difference measurements
- Automatic measurement of CSO, CTB, and cross modulation



1705A Spectrum Monitor

- Full 850 MHz span for international satellites
- L-Band and 70 MHz IF inputs
- Designed for satellite uplink & downlink monitoring
- On-screen Ku- or C-Band frequency readout
- Selectable 2 dB/div or 10 dB/div sensitivity
- Resolution bandwidth switchable to 10 kHz or 300 kHz
- Span range and video filter selection

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

For product detail, request a TV catalog by completing the business reply card in the back of this catalog.

ORDERING INFORMATION

For price information: Outside the U.S. contact your local Tektronix representative, inside the U.S. see the price list in the back of this catalog.

2714
Cable TV Spectrum Analyzer.

2721A
Sweep Transmitter.

2722A
Sweep Receiver.

Opt. 01 – Chart Recorder.

1705A
Spectrum Monitor.

MEASUREMENT SERVICE OPTIONS FOR 2721A/2722A
Call your local Tektronix representative for a full list of service options.

MEASUREMENT SERVICE OPTIONS
Opt. C3 (2714/1705A only) – Three years of Calibration Services.
Opt. C5 (2714/1705A only) – Five years of Calibration Services.
Opt. D3 (2714 only) – Test Data (requires Opt. C3).
Opt. D5 (2714 only) – Test Data (requires Opt. C5).
Opt. R3 (2714 only) – Repair warranty extended to cover three years.
Opt. R5 (2714/1705A only) – Repair warranty extended to cover five years.
See page 581 for further information.

Video Network Displays

PROfile
Our digital storage family includes the PDR100 Professional Disk Recorder and the PDR200 Networked Video File Server. PROfile solutions also include robotic tape libraries for storing extremely large volumes of material, RAID data protection and basic software applications. All are open systems that work with an extensive array of third-party products and applications.

GRASS VALLEY
Grass Valley solutions abound with an extensive range of systems designed for live broadcast, mobile news and sports production and post-production applications. Grass Valley products include production switchers, digital effects, edit controllers, routing switchers, master control and format conversion products.

LIGHTWORKS
Both the Lightworks Turbo and Heavyworks Turbo offline editing systems offer direct, random access to virtually unlimited digitized material through their ergonomic user interface. The V.I.P 4500 offers high-resolution online editing and program finishing. Newsworks Turbo is specifically designed for newsroom video editing applications.

NETSTATIONS
Our newsroom automation and editing systems provide a networked tool kit – from script based video editing to dynamic machine control to publishing your news on the Internet.

CONTENTS

NETWORKED DIGITAL VIDEO STORAGE PRODUCTS

Profile®
PDR200....574
PDR100....574
PLS200....574
PRS200....574
PRC100....574

PRODUCTION, ROUTING AND DISTRIBUTION SYSTEMS

Grass Valley™
110 Series....575
200 Series....575
1200 Series....575
2200 Series....575
3000 Series....575
4000 Series....575
Krystal™....575
DPM-700....575
VPE-300....575
Series 7000....575
Series 6000....575
Master 2100....575
Master 21™....575
MAX 9000....575
SMS 8000....575

NONLINEAR VIDEO EDITING SYSTEMS

Lightworks™
V.I.P 4500....576
Newsworks™ Turbo....576
Heavyworks™....576
Lightworks Turbo....576
Faders Console....576

NEWSROOM AUTOMATION AND EDITING SYSTEMS
NewStar™....577
EditStar™....577
Netstations CCapture™....577

NETSTATIONS
WinDD™....578

Networked Digital Video Storage Products

Profile® • PDR200 • PDR100 • P65200 • PRS200 • PRC100

Features

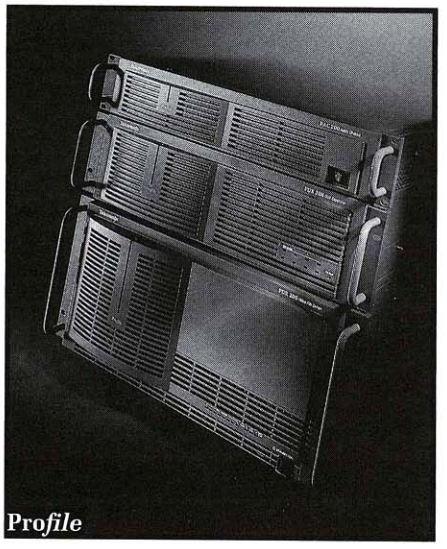
- Video File Server

PDR100

- Standalone – Fibre channel upgradeable
- 2 or 4 channels of broadcast – studio quality video
- Up to 96 hours of RAID protected storage
- Up to 9 hours of low cost storage
- Modular design, easy upgrades
- Open systems platform, Windows NT
- 16 channel CD quality audio
- Serial Digital I/O, Analog Composite I/O, Analog Component Input
- Mix Effects Option
- Professional Disk Recorder

PDR200

- Fibre Channel Networking with faster than real-time data transfer
- 2 or 4 Channels of Broadcast–Studio Quality Video
- Serial Digital I/O, Analog Composite I/O, and Analog Component Inputs
- 24-Bit AES/EBU Digital or CD Quality Analog Audio
- Up to 96 Hours of RAID Protected Storage
- Over 20 Hours of Low Cost Storage
- Modular Design, Easy Upgrades
- Open Systems Platform
- Library System
- RAID Storage
- Fibre Channel Upgrade
- Controllers
- Event Management System
- Tool Box



Profile

Profile Digital Storage Products

For broadcasters and post production facilities who need to easily share digital media (video and audio) among users, the Tektronix Profile family of networked digital video storage products is the first to deliver the benefits of shared access, improved reliability and increased efficiency for a better on-air look at a wide range of price and performance.

PDR200 VIDEO FILE SERVER
Unlike other solutions which offer a centralized storage solution, the new PDR200 delivers the benefits of distributed storage and faster than real-time video transfer over a high speed Fibre Channel network which will complement existing infrastructures of video routers. By keeping media in its compressed format, workgroups can share media quickly and reliably without a generation loss incurred when you copy video or when you decompress and re-compress video with standalone video disk recorders. When the media is ready to play to air, the PDR200 plays it out through the traditional video router to maintain compatibility with existing equipment. (Datasheet Part Number 2AW-1064)

PDR100 PROFESSIONAL DISK RECORDER
The Profile PDR100 provides broadcast-studio-quality video and audio manipulation and storage in a reliable system that has modular flexibility. The platform contains 2 or 4 independent disk recorder channels that can simultaneously play or record and provides random access to all stored information through any of the channels. The PDR 100 is an open platform, which not only adds flexibility for future expansion, but also makes it easy for developers to port applications system to the system. The Pro*file* PDR is ideal for time delay, spot insertion, disk caching and live event coverage applications. (Datasheet Part Number 25W-7249-6)

The PDR is the hub of an entire family of digital video storage, editing and production products. The Profile family gives you a way to put a foundation in place today to build the digital capabilities you need in the future, as you need them by adding any of these Pro*file* family solutions:

PLS200 PRO*file* LIBRARY SYSTEM
High capacity, low cost video storage for expanded spot management and news archiving capabilities. Request data sheet part number 2AW-1061-1 for details.

PRS200 PRO*file* RAID STORAGE
Compact RAID-3 disk system with 96 hours of storage for failsafe data protection. Request data sheet part number 2AW-1059 for details.

PRO*file* FIBRE CHANNEL UPGRADE
Providing enterprise-wide digital data exchange that is faster than real time. Request data sheet part number 2AW-1119 for details.

CONTROLLERS
PRC100 Pro*file* Remote Control Panel –

A simple remote control panel for the PDR100 which controls up to 4 channels through a single connection.

PRO*file* LVS EVENT MANAGEMENT SYSTEM
Unbelievable flexibility and control in live production. Request data sheet part number 2AW-1075 for details.

PRO*file* TOOL BOX
Simple, easy -to-use cuts only editor and list manager. Request data sheet part number 2AW-1062 for details.

To find out more about the Profile family of products, please call 1-888-TEK VIDEO.

See Tektronix on the World Wide Web: http://www.tek.com

Production, Routing & Distribution Systems

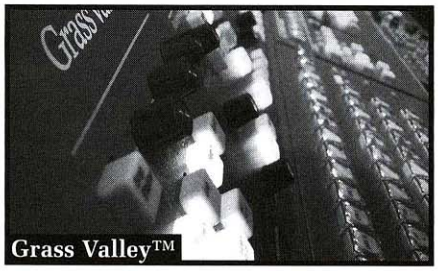
Grass Valley™

Features

- Production Switchers
  - Model 110 Series
  - Model 200 Series
  - Model 1200 Series
  - Model 2200 Series
  - Model 3000 Series
  - Model 4000 Series
- Digital Effects/Editor Controllers
  - Krystal™
  - DPM-700
  - VPE-300 Series
- Routing Switchers
  - Series 7000
  - Series 6000
  - Compact Routers
- Master Control
  - Master 2100
  - Master 21™
- Distribution Amplifiers
- Format Conversion Systemization Products
  - MAX 9000
  - SMS8000

For further information or the sales office nearest you, please contact: Tektronix, Inc. Video and Networking Division:
Phone: (800) 547-8949 (North America)
No. America Fax: (503) 627-7275
Europe Fax: 33 (1) 69 07 0937
Asia Fax: (852) 2802 2996
Japan Fax: 81 (3) 5992 9377
Latin America Fax: (305) 477-5385

See Tektronix on the World Wide Web: http://www.tek.com



Production, Routing, and Distribution Systems

Grass Valley production switchers, video effects and routing systems have set standards for the television industry worldwide. For more than three decades, broadcasters and other video users have depended on the Grass Valley brand for uncompromising quality, consistent reliability and unflagging support.

In real-time production, nothing less than impeccable signal quality will do. Grass Valley switchers provide operators with the simplest, most complete and easiest access to the widest range of sources, chroma keys, transitions and integrated effects – all designed for systemization with other production systems. In post-production, Grass Valley switchers are the standard for creative flexibility and integration with related production systems.The key to digital effects creativity is absolute video control through an intuitive interface. The Krystal digital effects system achieves a new level of operating ease and integration with Grass Valley switchers and editing systems.

Grass Valley Signal Management Systems meet the challenge of evolving video environments for today's mixed format, mixed media, multi-purpose facilities by managing all formats and data rates including those for advanced television systems. And, Tektronix will continue to provide long term scalable solutions that support the flexibility to change and grow as your needs evolve.

Combine all this with Grass Valley experience in master control to produce total facility automation that meets the needs of television program providers in every sector of the business.

PRODUCTION SWITCHERS

Model 110 Series – The ideal analog system for small studio production.

Model 200 Series – A powerful mid-sized analog system for live or post-production needs.

Model 1200 Series – A compact component digital switcher with component analog and digital inputs, making the transition to serial digital easy and cost effective.

Model 2200 Series – A high-performance two mix/effects component digital switcher at a mid-range price.

Model 3000 Series – A powerful multiformat composite digital two or three mix effects switcher with analog and digital inputs and outputs.

Model 4000 Series – The ultimate component digital switcher which is available in a choice of two or three mix effects models.

DIGITAL EFFECTS AND EDITOR CONTROLLERS

Krystal – A superior 10-Bit digital effects system providing dazzling real-time effects and outstanding creative control.

DPM-700 – An exceptional value in an 8-Bit digital effects device, offering a dramatic combination of 3-D rotation effects and variable perspective.

VPE-300 Series – The VPE Series consists of three full-featured systems with seamless upgrades from basic offline production to automated control of the largest edit suites.

ROUTING SWITCHERS

Series 7000 – A multiformat signal management system providing superior control systems, step-by-step expansion in sizes ranging from 16x16 to 1024x1024, and total integration with other Grass Valley products.

Series 6000 – A compact multiformat video/audio/data routing system available in 16x16 and 32x32 configurations.

Compact Routers – A choice of 10x1 analog or serial digital systems for assignment routing applications.

MASTER CONTROL

Master 2100 – A digital master control system featuring integrated SqueezeBack™ effects, integrated Pro*file*® clip stacking, and multichannel, multipanel capabilities.

Master 21 – A single-channel analog master control switcher providing extensive control over video and audio sources.

DISTRIBUTION AMPLIFIERS

Grass Valley distribution amplifiers include 8500/8800 Series Analog Video, 8900 Series Serial Digital Video, and 8550/8560 Series Stereo Audio Distribution Amplifiers.

FORMAT CONVERSION AND SYSTEMIZATION PRODUCTS

MAX 9000 and SMS 8000 – Systemization products that provide format conversion, multiplexing, demultiplexing, and distribution of various video and audio signal formats.

Nonlinear Video Editing Systems

Lightworks™ • Newsworks™ • Heavyworks™

Features

- News Editing System
  - Lightworks V.I.P 4500
  - Newsworks TurboNews
- Post Production Editing System
  - Heavyworks
- Offline Editing System
  - Lightworks Turbo
- Faders Console

Lightworks V.I.P 4500 Online Editing System

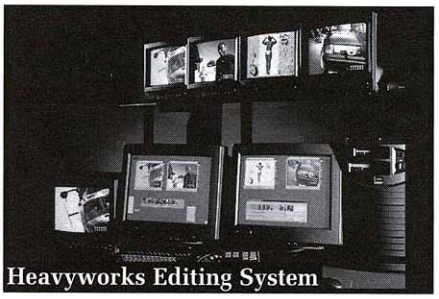
The Lightworks V.I.P 4500 system brings true nonlinear performance to high-resolution program finishing. It retains all the versatility and functionality of Lightworks editing systems while adding channels of full online picture quality. Individual streams of video can be digitized into the V.I.P system simultaneously yet controlled independently, allowing a rough cut of your program to be created shortly after a shoot is completed. In addition to these internal capabilities, the V.I.P 4500 provides real-time control of existing external online devices such as DVEs, production switchers, graphics systems and character generators. It's the ideal solution for streamlining the work flow of demanding broadcast applications and auto-conforming in post-production environments.

Newsworks Turbo News Editing System

The Newsworks Turbo news editing system thrives on deadlines. All the features that make Lightworks systems a fixture in the world's top editing suites are available – with several additions designed to help get that "scoop" on the air before the competition. Editors can digitize feeds, add titles and effects and finish segments with play-to-air quality. Shots can even be selected from a source VTR and digitized directly into an edit on the Newsworks Turbo system. To further speed up the production process, narration can be recorded against an edit that is being replayed in real time. As part of a complete news solution, the Newsworks Turbo system can also be remote controlled via newsroom automation systems.

Heavyworks Editing System

The Heavyworks editing system is the solution for today's most demanding post-production environments. Offering a potent combination of tools for editing picture and sound, the Heavyworks system has achieved international success for cutting major feature films and offline editing of long- and short-form video projects. It has the muscle to control four separate, locked sources in real time, with the option of additional viewers chasing in sync. Shots from multiple cameras can be



Heavyworks Editing System

arranged in Sync Groups, or separate takes can be locked together and viewed simultaneously. Add the optional Lightworks Faders Console, and editors gain control over assignable fader groups with instant recall of stored level settings.

Lightworks Turbo Editing System

Since its introduction in 1991, hundreds of projects around the world have depended on the Lightworks Turbo system to bring increased creativity and greater productivity to offline editing. The system offers direct, random access to virtually unlimited digitized material, and its "cutting-room style" interface gives editors the freedom to arrange their workspace to suit their individual tastes. With its award-winning adaptability and high performance, the system is at home in broadcast television studios, feature film and television edit rooms, commercial post houses, corporate production facilities or any other professional post-production environment.

Faders Console

Optimized for use with the Heavyworks editing system, the Faders Console is a stand-alone, automated controller with a range of facilities for audio finishing. It provides fully assignable fader channels with instant recall of stored level settings and four editing modes. Mixing then becomes an interactive part of the editorial process – not a chore performed afterwards – potentially saving valuable time during audio post production.

For further information or the sales office nearest you, please contact: Tektronix, Inc. Video and Networking Division:
Phone: (800) 547-8949 (North America)
No. America Fax: (503) 627-7275
Europe Fax: 33 (1) 69 07 0937
Asia Fax: (852) 2802 2996
Japan Fax: 81 (3) 5992 9377
Latin America Fax: (305) 477-5385

See Tektronix on the World Wide Web: http://www.tek.com

Newsroom Automation and Editing Systems

NewStar™ • EditStar™ • CCapture™

Features

- News Production System
  - Nonlinear Editing system
  - LAN Browser
  - Web Publisher
  - Closed Caption Automatic Transcription System
- Open System Desktop System
  - Multiuser Access to PC Application
  - Simultaneous Access Any Computer Environment

NewStar News Automation and Editing Systems

It's never been easier to rise above the challenges of the newsroom to deliver timely, creative, effective news broadcasts. NewStar products deliver the most powerful, efficient news automation system you can find today, while giving you a foundation for growth into new cost-saving technologies.

NEWSTAR FOR WINDOWS
NewStar for Windows streamlines news production for incredibly fast and powerful control of news gathering, editing, organizing and reporting. NewStar for Windows takes full advantage of open system standards and a building-block approach. This innovative program is written as a "toolbox" collection of separate and highly compatible applications for greater flexibility. The NewStar is also designed to integrate with resource management tools that access and manage every aspect of the news production and transmission process.

EditStar
The first nonlinear editing system to be designed entirely for the needs of journalists, EditStar is a sophisticated tool that's incredibly simple to learn and use. Just type the script, view the video and drag-and-drop to dynamically match video with script text. Changes made to one automatically affect the other. All on a single workstation, with instant access to all materials. It's editing that moves at the speed of thought.

NewStar LAN BROWSER
View edited news video from any standard workstation with NewStar LAN Browser software. The browser gives you the ability to store hundreds of hours of video while maintaining links to written scripts, allowing users to view and hear low resolution edited clips or archives. This lets a producer or news director review all the edited video before a show – without leaving their desk. And a journalist or editor can do a word search on an archived script and see and hear the edited clip associated with it, before transferring a broadcast-quality copy to the Pro*file*® Disk Recorder for further editing.

NewStar WEB PUBLISHER
Looking for a wider audience for your stories? Web Publisher puts your newsroom just a mouse click away from the World Wide Web. Attached to a NewStar System, NewStar Web Publisher can send information directly to your web server. And if you're not on the Internet yet, Web Publisher can help you build a web page! Just click on icons in the Windows-based interface to send your news program to the Web – complete with script, graphics and video.

CCapture
Putting CCapture on your system is even better than having four stenographers on call! Anything that is closed captioned – including your competition's newscasts, your affiliate feeds, sports events and presidential speeches – can be captured, time-stamped and transcribed automatically by the CCapture system for later review and analysis.

NewStar LEADER PLUS™
Sports scores. School closings. Election returns. These are the big ratings generators for any newsroom. Manage them right, and your viewers will tune in day after day. Leader Plus is the software that packages these three powerful applications in a single, seamless solution. A Microsoft Windows 95 or Windows NT, 32-Bit based application, Leader Plus software ingests wire agency information and controls character generators. Its easy-to-use graphical user interface simplifies operation, providing instant customized printed reports with the click of a mouse. It even enables the use of a touch-tone telephone to hear or update information.

For further information or the sales office nearest you, please contact: Tektronix, Inc. Video and Networking Division:
Phone: (800) 547-8949 (North America)
No. America Fax: (503) 627-7275
Europe Fax: 33 (1) 69 07 0937
Asia Fax: (852) 2802 2996
Japan Fax: 81 (3) 5992 9377
Latin America Fax: (305) 477-5385

See Tektronix on the World Wide Web: http://www.tek.com

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Netstations

WinDD™

Multiuser Access to PC Applications

The WinDD operating system software's industry-leading performance and PC functionality unite your enterprise and provide the ultimate open system desktop solution for your organization. The WinDD system delivers PC applications in native mode to all kinds of devices, including netstations, X terminals and UNIX workstations. So users working on local area networks have access to Pentium performance and full Windows functionality.

Multiple users can now have direct, simultaneous, open systems access (not emulation) to PC applications running on a network server from their UNIX workstations or other color X11 compliant devices, Tektronix netstations, PCs in the office or at home or laptops in remote locations. The WinDD family of products delivers seamless access to Windows 3.1, Windows NT and Windows 95 applications as well as DOS and OS/2 character-based applications to the desktop. The WinDD system provides the ultimate open systems desktop solution for your organization, with industry-leading performance and true PC functionality. ICA provides increased performance and a greater number of users by offloading the application server and reducing network traffic by up to 75% over other solutions.

SIMULTANEOUS ACCESS TO ANY COMPUTER ENVIRONMENT

With the WinDD system, users can simultaneously open application windows into PC application servers, UNIX hosts and mainframes. On netstations, UNIX workstations and other X11 compliant devices, users have full cut, copy and paste between PC and X windows for easy transfer of data between application in both environments.

The WinDD system also supports PC users over the LAN or dial-up. System administrators can remotely run WinDD administration tools from their notebook PCs wherever they are. PCs can also be used at the desktop for accessing central applications on the WinDD server.

PC application features include multiple screen resolutions, the latest printer drivers and local floppy support. UNIX features include NFS, TCP/IP, support for local floppy on Sun, HP, SGI and IBM workstations and centralized administration support.

Only Tektronix can supply system administrators with centralized tools as well as the choice of ICA datastream to balance TCP/IP network loads.

General Customer Information

Tektronix Sales and Service Offices

Tektronix products and technical support are available through a worldwide network of sales and service offices. Your Tektronix Account Manager is available to answer your questions. See the sales and service office list in the back of this catalog.

Tektronix TeleBusiness Center (TBC)

The same quality support found in our sales and service offices is available toll free. In the U.S., just call (800) 426-2200 Monday through Friday, from 9:00 am Eastern Time to 5:00 pm Pacific Time. With one call you are in touch with Tektronix' experts who can answer your questions, provide product information, help you select the right equipment, and supply user technical support. For solutions to your measurement equipment needs, give us a call.

Authorized Tektronix Distributors and Manufacturers Representatives

Authorized Tektronix Distributors and Manufacturers Representatives offer selected products in geographic areas. They will provide you with fast, convenient service and support. Ask your electronics distributor or representative if they carry Tektronix. Take advantage of their support and purchase Tektronix products from them.

As you use this catalog, note these products that are available through our distributors and representatives. To find the distributor or representative nearest you, see the list in the back of this catalog. Questions? Call (800) 479-4490 in the U.S.

Lease and Rental Programs

Tektronix measurement products are available under a variety of lease and rental programs offered by Tektronix and Tektronix Authorized Rental Companies. For lease and rental program details and a list of our Authorized Rental Companies, see page 580.

Warranty

Products offered by Tektronix are manufactured to provide the highest level of reliability and performance. Tektronix warrants these products against defects in materials and workmanship in accordance with the warranty statement applicable to each product. If any product fails during the warranty period, Tektronix will provide the remedy set forth in the applicable warranty. A copy of the warranty applicable to a particular product offered by Tektronix may be obtained from your nearest Tektronix office.

General Terms

PRICES
Prices in this catalog are U.S. list prices in effect at the time of printing. Export pricing information is available from your nearest Tektronix Office. Tektronix reserves the right to change prices without notice.

PAYMENT
Net 30 from date of invoice, subject to approved credit. Other terms are available.

CREDIT CARDS
Tektronix currently accepts the following credit cards: VISA, MasterCharge, Discover, American Express.

SHIPMENT
FOB Tektronix plant.

ELECTRONIC DATA INTERCHANGE
Tektronix encourages the use of EDI/EC to communicate quotations, orders, invoices and payment. If you are capable of this medium, please contact your Tektronix office and let us know.

CONTENTS

GENERAL BUSINESS INFORMATION
Sales/Service Offices 591
TeleBusiness Center 579
Technical Support 581
Distributors/Representatives 596
Selected Products and Geographic Areas
Fast, Convenient Service and Support
Warranty 579
General Terms 579
Leasing/Rental Programs 580
U.S. Government Customers 580

CUSTOMER SUPPORT/SERVICE
Technical Support 581
Calibration Services 582
Warranty, Repair and Upgrade Services 584
Service Options 585
Agreement and On-demand Service 586
TekSelect™ PRODUCTS 587
TRAINING/SEMINARS 588
POWER CORDS/PLUGS 589
APPLICATION/TECHNICAL NOTES 590

SALES/SERVICE OFFICES LISTING
Worldwide 591
U.S. 594
Distributors 596
Representatives 605
Leasing Companies 605
Rental Companies 605

FEEDBACK
Please provide feedback to Tektronix via the World Wide Web or by completing the Business Reply Card in the back of this catalog.

General Business Information

Features

U.S. GOVERNMENT CUSTOMERS
- Federal Order Management Office
- GSA Contract Information
- Logistics Data Book

MEASUREMENT PRODUCTS LEASING PROGRAM

AUTHORIZED RENTAL/LEASING COMPANIES

U.S. Government Customers

FEDERAL ORDER MANAGEMENT OFFICE

U.S. Government agencies should obtain price, delivery and place orders directly with Tektronix Federal Order Management at (800) 682-1210. Federal Agency RFQs, RFPs, IFBs, Purchase Orders and Contracts should be sent directly to:

Tektronix, Inc.
Federal Order Management M/S 50-290
P.O. Box 4600
Beaverton, OR 97076

FAX: (503) 629-5388
Phone: (800) 682-1210

GSA CONTRACT INFORMATION

Tektronix, Inc. has General Service Administration Multiple Award Schedule Contracts for many products listed in this catalog. These contracts are:

- Instruments and Laboratory Equipment; FSC Group 66, Class 6625, Part II, *Section H*
- Instruments and Laboratory Equipment; FSC Group 66, Class 6625, Part II, *Section J*

An Authorized GSA Price List for any of the above contracts is available from your nearest Tektronix office or by calling (800) 682-1210.

Selected Tektronix products are available through GSA MAS contracts held by Tektronix Authorized Distributors. **For information on MBD products available through this channel, call (800) 682-1210.** For information on Tektronix Color Printing and Imaging Division products available under GSA MAS contracts, call (800) 835-6100. For information on Tektronix Video and Networking Division products (including Grass Valley products) on GSA MAS schedules, call (800) 547-8949, extension 4666.

LOGISTICS DATA BOOK

Logistics data on products, accessories and parts sold by Tektronix is available from your nearest Tektronix Sales Office or (800) 682-1210. This data includes National and NATO Stock Numbers, military nomenclature, products provisioned by the military and other related data.

Tektronix Measurement Products Leasing Program

Although Tektronix will continue to offer leasing opportunities through our well established leasing company partners, customers now have the option to lease new measurement products directly from Tektronix. You can make arrangements to lease at the time product selections are made. Tektronix leasing terms include a variety of 12-, 24-, and 36-month programs with a minimum order of $3,000. In addition, our FlexLease™ program offers a very competitive monthly rate for 39 months with many attractive features. Contact your Tektronix Account Manager, or call the Tektronix TeleBusiness Center at 1-800-426-2200 (at the prompt, press 3).

Authorized Rental/Leasing Companies

Tektronix' Authorized Rental Companies provide the widest selection of well-maintained Tektronix instruments, with flexible and attractive terms. For short term rentals, leases and lease purchase options, Tektronix' Authorized Rental Companies provide the right terms, the right instruments, the right options so you can make the right choice.

Our Authorized Rental Companies can provide you a solution when you want to try out new equipment before you purchase or when you need equipment for short-term projects or for an immediate requirement. They will provide you the best answers for managing your test equipment inventory, whether you rent it for a month or lease it for a year.

When you need to rent or lease Tektronix products, look to our Authorized Rental Companies. Call:

AT&T Capital Corporation Instrument & Data Services	**1-800-874-7123**
Continental Resources, Inc.	**1-800-937-4688**
Electro Rent Corporation	**1-800-688-1111**
G.E. Capital Test Equipment Management Services	**1-800-GE-RENTS (1-800-437-3687)**
McGrath RentCorp	**1-800-352-2900**
McGrath RenTelco	**1-800-233-5807**
Telogy, Inc.	**1-800-TELOGY-I (1-800-835-6494)**

GSA price lists and/or government logistics data book are available. Call your nearest Tektronix office (listed in the back of this catalog) or (800) 682-1210.

See Tektronix on the World Wide Web: http://www.tek.com

Customer Support

Features

CUSTOMER SUPPORT PROGRAMS

- Calibration Services
- Product Updates
- On-site and Mobile Service
- Product Upgrades
- Repair Services
- Customer-site Installations
- Long-term Product Support
- Training and Assistance
- Product and Technical Seminars
- Operational and Applications Workshops
- Module Exchange Services
- Replacement Parts
- Technical Support

NOTE: Customer support programs vary according to country. For information on programs available in your location, contact your Tektronix representative (listed in the back of this catalog).

APPLICATIONS SUPPORT

- For Applications Support call:
  1-800-835-9433, Ext. 2400

  Outside the U.S., call:
  1-503-627-2400

  E-mail Address:
  "tm_app_supp@tek.com"

  Hours: 6:00 AM to 5:00 PM Pacific Time

SOFTWARE BULLETIN BOARD

- Software Bulletin Board 24 hrs., 7 days a week. 2400/9600 baud, dial 503-627-5658

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

Request a copy of our Measurement Service Brochure detailing service options available to you.

See Tektronix on the World Wide Web: http://www.tek.com

Total Solutions for Your Success

There is more in the box than a quality product when you purchase your product from Tektronix. You'll find an array of services that provides total-solution coverage – coverage that begins with your first call to Tektronix and continues after the sale through long-term product support. Our sales and service personnel work together to help you make the best selections for your applications. Then we help you maximize your investment by ensuring optimum product performance. All this is accomplished through customer support programs ranging from training to product installations and a variety of service plans.

Contact your nearest Tektronix office. Our U.S. and international office locations are listed at the back of this catalog. We will give you information on products and the names of Account Managers assigned to serve your product interests.

SERVICE OFFERINGS

Advancing technology has brought incredible change to the power of measurement instruments. Manufacturing methods and calibration techniques have been revolutionized, making the service challenge tougher than ever. With Calibration requiring dedicated ATE test systems, and repair using factory prepared modules, only the original manufacturer can fully support most of today's products.

Put simply, nobody can service your Tektronix product better than Tektronix.

CUSTOMER-SITE INSTALLATIONS

Tektronix provides on-site installations for most Tektronix-configured systems, setting up your product to meet all operating specifications. Contact your nearest Tektronix office for more information.

LONG TERM PRODUCT SUPPORT

Tektronix has a long-standing policy to provide service coverage after a product has been removed from the catalog, subject to parts availability. Contact your Tektronix service center for service quotes and information.

TRAINING AND ASSISTANCE

Your product is most useful to you when you are thoroughly familiar with it. Formal training classes and self-study aids can help you get up to speed faster. Contact your Tektronix office for details about customer training.

SEMINARS

To receive information about our free Tektronix product and technical seminars, contact your Tektronix sales office and ask to be added to the seminar mail list. See page 588.

OPERATION, APPLICATIONS, AND SERVICE WORKSHOPS

Achieve optimum utilization of your equipment. Let Tektronix provide fast-paced courses with classroom lectures and supervised hands-on laboratory sessions. Participants receive manuals and workbooks containing detailed course notes and lab exercises. For added convenience, Tektronix also offers private workshops conducted at your company. See page 588.

MODULE EXCHANGE SERVICES

Easily exchangeable modular components facilitate rapid troubleshooting and repair of many products offered by Tektronix. You may choose to diagnose a problem and specify the module to exchange, or a Tektronix customer service technician can provide assistance. Typically your module order will ship from our plant within 24 hours, and overnight delivery can be arranged for most U.S. locations. To place an order, call Tektronix at (800) 835-9433, Ext. 6630.

REPLACEMENT PARTS

Replacement parts and supplies can be ordered by calling toll free between 5AM and 5PM, Pacific Time. Call Tektronix at (800) 835-3553.

TECHNICAL SUPPORT

Tektronix provides high quality Technical Support on applications, operation, measurement specifications, hardware, and software by expert application engineers. See contact information at left.

Calibration Services

Features

CALIBRATION SERVICES

- Calibration for Your Compliance to Standards (ANSI/NCSL Z-540/ISO GUIDE 25) and ISO9000 Quality Systems
- Calibration for Peak Performance
- Ensure Continued Reliability – Opportunity for Latest Manufacturer's Updates
- Enhance Product Performance and Feature Set – Ideal Time to Install Optional Upgrades
- ISO9000 Approved Service Centers
- Accredited Metrology Laboratories
- Local Services From a World-wide Network of Service Centers Sharing Information

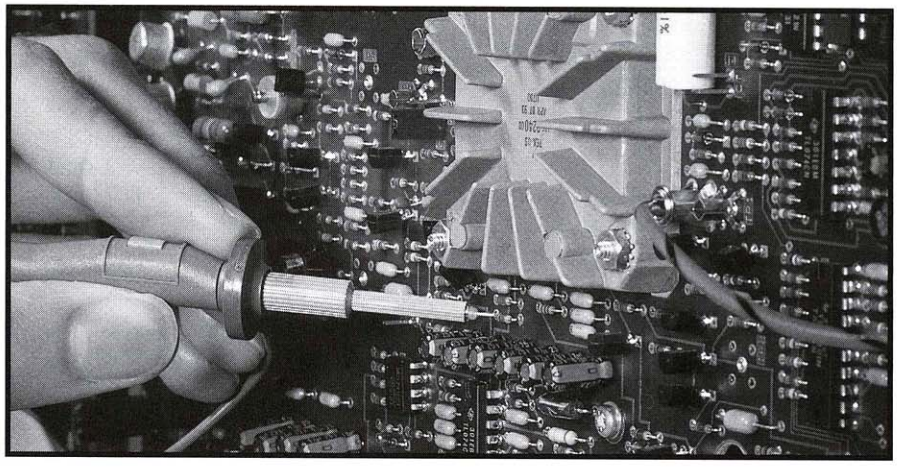
Tektronix has the training, documentation, factory support and equipment to calibrate your instruments quickly and to the highest standards.

NOTE: Services may vary according to country. For information on programs available in your location, contact your Tektronix representative.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

Request a copy of our Measurement Service Brochure detailing service options available to you.

See Tektronix on the World Wide Web: http://www.tek.com



The Need for Calibration

All measurement instruments require routine Calibration – with today's quality systems it's important to get the right service.

WHAT IS CALIBRATION?

Calibration is the process of regularly verifying an instrument's performance, against known standards, to determine whether it is still within specification and hence still suitable for its application.

Calibration can also determine whether measurements made in the period before the calibration were valid. Herein lies a major part of the value of calibration.

ISO9000 REQUIREMENTS

Reporting the measured values of any parameters found to be out of specification is an ISO requirement. This information is needed to determine what remedial actions, if any, need to be taken with prototypes or products tested using an instrument that may have been out of specification.

(The impact statement documents the action to be taken under a quality system when a particular test instrument is found to be out of specification – it will depend on the nature and severity of the out of tolerance condition).

WHY REGULAR CALIBRATION?

Manufacturers recommend a calibration interval to provide a high level of confidence that with regular calibration, the product will remain within specification during that period.

Clearly if an instrument is found out of specification, the longer the interval since last calibration, the more measurements it will have made, possibly in error – so regular calibration minimizes the risk to your operations in terms of the extent of remedial actions required.

ALL CALIBRATIONS ARE NOT THE SAME

Some calibrations may only test a limited number of parameters; this may mean that a parameter critical to your application is not tested. Some may make adjustments before completing the in-spec verification; so that an out-of-specification parameter is not detected. And others may have an extra charge for data on failed parameters (offering you only after adjustment data as the standard level of calibration). Any one of these means you cannot reliably determine if a remedial action is required and may expose you to a quality system non-compliance.

Calibration Services

MEETING YOUR NEEDS

Tektronix Calibration Services are designed for the specific needs of instrument users and the demands of today's highly regulated quality environments:

Calibration – Verification

Meets most Calibration needs including those of customers working to quality standards like ISO9000. This service includes:

- Detailed reporting of parameters found out of specification – the Tektronix Report of Verification Failures, vital for ISO
- Necessary adjustments
- Certificate of Traceable Calibration
- Service Report
- Integrity Seals and Calibration Label

Optional Test Data is available.

Calibration – Optimization

A unique service for circumstances where the best possible guarantee of spot measurement accuracy is required. This service includes:

- Detailed reporting of parameters found out of specification – the Tektronix Report of Verification Failures, vital for ISO
- Full adjustments to bring instrument Calibration into center ranges
- Certificate of Traceable Calibration
- Service Report
- Integrity Seals and Calibration Label

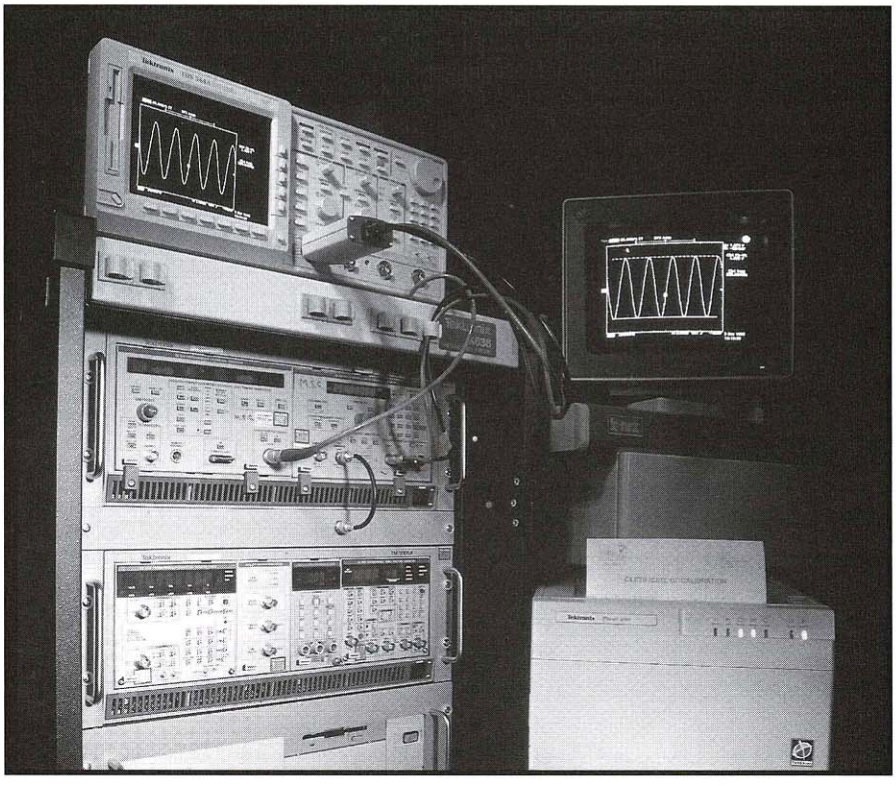
Optional Test Data is available.

METHOD OF SUPPORT

- Return to Service Center
- On-site/Mobile Service (availability is product type dependent and may vary by geography)

AVAILABILITY

- Service Options with Your Instrument Order
- Tektronix CAL Products Through Your Distributor
- Annual Service Agreement
- Service On-demand
- Customized Support



DIMENSIONAL STANDARDS SERVICES

Calibration and repair of your dimensional tools are available at selected Tektronix Service Centers. Dimensional Lab Services are another example of Tektronix commitment to staying at the forefront of Metrology, and partnering to keep your calibration equipment working for you.

PRODUCT UPDATES FOR CONTINUED RELIABILITY

Sharing service information across our world-wide organization enables us to identify and install the latest manufacturing updates – ensuring the continued reliability of your Tektronix products.

Annual Calibration provides the regular opportunity to benefit from a level of service that only the original manufacturer can offer.

Warranty, Repair and Upgrade Services

Features

REPAIR SERVICES

- Manufacturer's Technology and Product Knowledge for Accurate Diagnosis and Quality Service
- World-wide Logistics Infrastructure for Fast Turnaround
- Supported from Tektronix Headquarters in the USA
- Access to Tektronix Design, Engineering and Manufacturing Teams
- Using Only Original Parts, Modules and Procedures
- ISO9000 Approved Service Centers
- Local Services From a World-wide Network of Service Centers Sharing Information

PRODUCT UPGRADES

- Enhance Product Performance and Feature Set as Needs Change

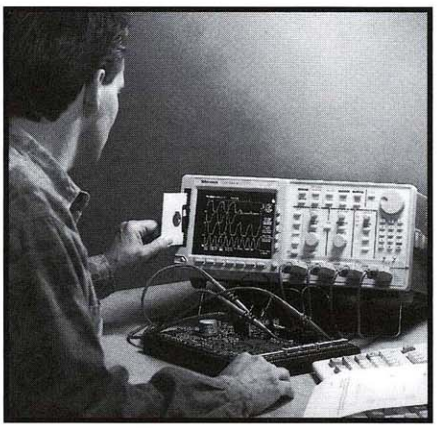
Tektronix products deserve Tektronix Service.

NOTE: Services may vary according to country. For information on programs available in your location, contact your Tektronix representative.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

Request a copy of our Measurement Service Brochure detailing service options available to you.

See Tektronix on the World Wide Web: http://www.tek.com



The Highest Standards

Tektronix products are built to exacting standards and backed by our comprehensive warranty. It's reassuring to know that if the unexpected happens, Tektronix expertise is at hand to provide repairs of the highest quality.

WARRANTY

Information on the warranty applying to your Tektronix product is available from your Account Manager or Service Center, and from our Service World Center on the World Wide Web.

Our warranty Repair service restores performance to original factory standards, and any existing Tektronix Calibration will be re-validated to its original expiration date.

Because our service systems are pre-loaded with details of your new product, we are ready to serve, should you need us – getting your instruments back to work with minimum fuss and downtime.

Service Options, available at time of instrument purchase, allow you to extend the security of your Tektronix Repair warranty. With service options, you fix your long term support costs and receive priority service when you need it.

TEKTRONIX REPAIR SERVICES

Outside warranty or extended Repair warranty, Tektronix expertise and resources are still available to give your equipment a clean bill of health.

You can obtain the security of year round Repair coverage through an annual Service Agreement.

Alternatively, Repair services are available On-demand, with the convenience of standard prices.

MEETING YOUR NEEDS

Tektronix Service offers a range of flexible Repair solutions:

- Warranty
- Extended Repair Warranty
- Annual Agreement for Repair Coverage
- On-demand Repair Service

PRODUCT UPGRADES TO ENHANCE PERFORMANCE

Safeguard your original investment in a Tektronix product by enhancing its capabilities through Product Upgrades. Having your instruments calibrated or repaired by Tektronix is an ideal opportunity to invest in an optional upgrade to enhance performance or add to the feature set.

Contact us for details of upgrades available for your product.

METHOD OF SUPPORT

- Return to Service Center
- On-site/Mobile Service (availability is product type dependent and may vary by geography)

AVAILABILITY

- Service Options with Your Instrument Order
- Tektronix REP Products Through Your Distributor
- Annual Service Agreement
- Service On-demand
- Customized Support

DO YOUR OWN REPAIR AND CAL?

We understand that you may prefer to use your own in-house resources. We can supply service manuals, parts and service training to support you. Let Tektronix be your partner.

Service Options with Your Product Purchase

Features

SERVICE OPTIONS

- Easy to Add to Your Product Purchase
- Protect Your Investment from Day One
- Maximize Productive Uptime for Your Instruments
- Priority Turnaround from Our Service Centers
- Eliminate the Annual Hassle and Delays of Quote, Administration and Internal Paperwork
- No Need to Seek Approval for On-demand Services
- Fixed Lowest Life-cycle Cost of Ownership – Save Over Any Other Way to Buy
- The Security of Tektronix Expertise

Tektronix Service Options make it a simple and sensible choice.

NOTE: Service Option availability is product type dependent and may vary according to country. For information on programs available in your location, contact your Tektronix representative.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

Request a copy of our Measurement Service Brochure detailing service options available to you.

See Tektronix on the World Wide Web: http://www.tek.com

Why Buy Service with Your Instrument?

You'll gain significant savings, maximize your productive uptime through scheduled service with priority turnaround, and eliminate the annual administrative delays and hassles of arranging unplanned services.

Tektronix Service Options are modular, flexible, and easy to order with your instrument. Choose the combination that's right for you and relax in the knowledge that your investment is protected for the first 3 or 5 years of its life!

INSTALLATION

Our installation option saves you valuable engineering time, keeps your staff focused on their real project tasks and brings you productive results faster:

Option IN – Product Installation

Installation Option IN provides configuration, then following delivery, a Tektronix specialist will complete the installation, ensuring that your product is fully functional and ready to use. You'll receive a start-up training session, providing front panel and product familiarization, enabling you to begin working effectively in minimum times.

CALIBRATION

Tektronix Calibration options are specifically designed to the requirements of standards including ISO9000 and ANSI/NCSL Z-540, in terms of both the technical service performed and the documentation supplied:

Option C3 – 3 Years of Calibration
Option C5 – 5 Years of Calibration

Options C3 and C5 include initial certification on delivery and then two or four more Calibrations, respectively, from your Service Center.

Initial certification is from our ISO9001 approved manufacturing facilities with traceability to NIST. Further annual Calibrations are with Tektronix recommended Cal-Verification service (see page 582) with traceability to local, national, and/or international standards.

Naturally any necessary product updates are included, and you can also take advantage of optional upgrades available to enhance the performance or feature set of your instrument.

TEST DATA

The recorded values of measurements made to test an instrument's performance during Calibration:

Option D3 – Test Data
(order in addition to Option C3)
Option D5 – Test Data
(order in addition to Option C5)

With Options D3 and D5 Test Data from manufacturing is included on delivery. For subsequent calibrations the Report of Verification Failures (see page 582) is replaced with comprehensive before data and after data for any parameters affected by necessary adjustments.

EXTENDED REPAIR WARRANTY

It's always reassuring to be protected by the manufacturer:

Option R3 – Warranty extended to Cover 3 Years

Option R5 – Warranty extended to Cover 5 Years

Extending your product warranty fixes your long term maintenance costs, eliminates unplanned expenditure, and guarantees you the security of a priority repair service from the experts, with no additional paperwork.

ON-SITE SERVICE

Nothing beats the convenience and security of having services performed at your own site. Now it's easy to order the expertise of the Tektronix Mobile Team as a Service Option with your new instruments:

Option S1 – 1 Year upgrade to On-site

Option S3 – 3 Year upgrade to On-site

Option S5 – 5 Year upgrade to On-site

On-site Service Options uplift the standard return to depot coverage of warranty, extended warranty or Calibration Service Options, to provide On-site Services.

You can pre-book visits for Calibration, arranging them in advance to suit your schedules, and repair is provided on a priority basis, further increasing your uptime.

DISTRIBUTOR SERVICE PROGRAMS

You can pre-purchase genuine return to Tektronix Service when purchasing products from our network of Authorized Distributors.

Some products will be eligible for Service Options. Others, which you are most likely to purchase from distributor stock, can be covered for Calibration and extended Repair warranty services by purchasing a Tektronix CAL or REP Program.

Obtain details from your Distributor, or from your local Tektronix Service Center.

Agreement and On-demand Services

Features

SERVICE AGREEMENTS

- Your Investment Protected with Pre-Planned Services
- Fixed Annual Costs – No Surprise Expenses
- Eliminate the Delays for Quote and Approval Process with On-demand Service
- Multi-vendor/One-stop and Custom Service Solutions Available
- On-site Service
- The Security of Tektronix Expertise

Secure, Flexible, Pre-arranged Annual or Multi Year Service Coverage – to Complement Your Own In-house Capabilities or Provide a Total Service Solution.

SERVICE ON-DEMAND

- Best Solution for Unplanned Services
- Convenient Standard Prices for Both Calibration and Repair Services – Buy with Confidence
- The Security of Tektronix Expertise

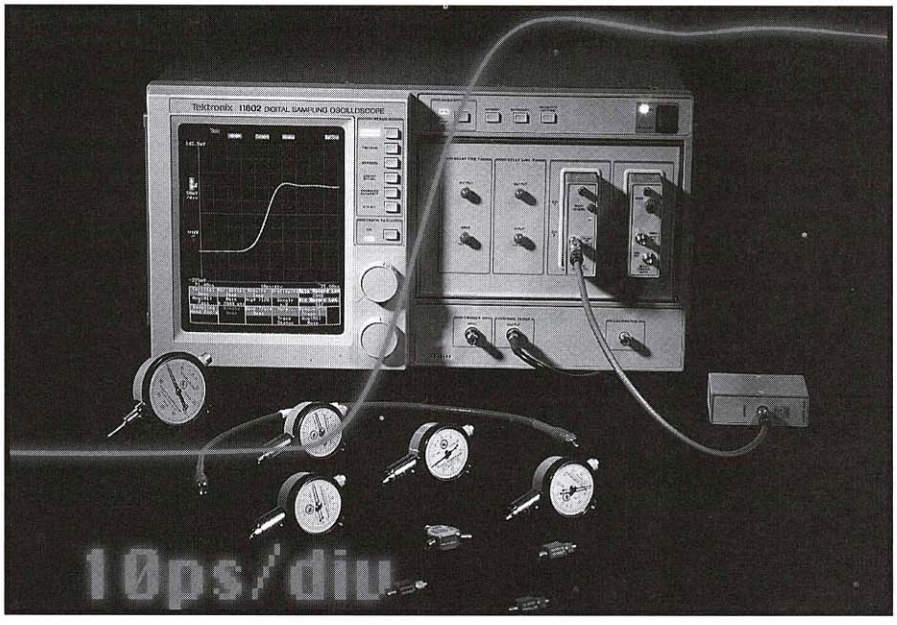
Tektronix On-demand Services provide a convenient means to handle per-incident Calibrations or repairs not covered by Service Options or a Service Agreement.

NOTE: Services may vary according to country. For information on programs available in your location, contact your Tektronix representative.

For your local Tektronix representative see the list in the back of this catalog or outside the U.S. call: 1-503-627-1933, inside the U.S. call: 1-800-426-2200.

Request a copy of our Measurement Service Brochure detailing service options available to you.

See Tektronix on the World Wide Web: http://www.tek.com



Flexible Service

In addition to Service Options, Tektronix Calibration and Repair expertise can also be secured under a Service Agreement, covering specific products and serial numbers. Alternatively Service On-demand caters to purchases on a per-incident basis.

SERVICE AGREEMENTS

When your product warranty or Service Option coverage expires, consider the cost effectiveness of purchasing an annual Service Agreement.

Service Agreements provide substantial cost advantage over On-demand Service costs. Multi-year coverage minimizes your paperwork and affords you tighter control over your ownership costs.

Most important, Service Agreement protection helps you maximize your instrument uptime and performance.

Reduced Cost of Ownership

Tektronix Service Agreements foster a disciplined approach to providing superior quality, performance and value, by assuring in advance that any care your Tektronix products need will be provided. Instruments maintained in this manner perform faithfully and experience an extended useful life, which translates into a lower cost of ownership.

Total Solution

The experience and capabilities developed to support our own products mean that we are uniquely positioned to support instruments from other vendors.

In addition, key alliances with other qualified service providers extend our capability to provide a complete One-stop Metrology and service solution. In this way, a Service Agreement is the ideal framework for us to support your operations.

Earn Discounts

Service Agreements may be discounted as a counterpart to multi-year coverage or volumes.

Please ask your Service Account Manager for details.

SERVICE ON-DEMAND

Tektronix offers per-incident Calibration and Repair services for most products on a standard price basis. This lets you make a service decision without waiting for a quote, allowing us to go to work for you right away.

(Products that have been damaged through accident or improper use may be ineligible for Standard Price).

PREMIUM VALUE WITH EXTRA CARE

We treat every instrument service as an opportunity to deliver the extra care that sets Tektronix apart from other service providers. Our Unconditional Service Guarantee:

"If, for any reason, our services fail to fully meet your requirements as promised, we will resolve the problem at our expense."

TekSelect™ Products

"TekSelect"

That's Tektronix new program name for our reconditioned inventory. It's our second chance at making another happy customer with these products. We have a huge selection of inventory that spans our entire product portfolio. Logic Analyzers, Spectrum Analyzers, General Purpose Scopes... you name it, and we've probably got it in stock!

TekSelect inventory consists mostly of instruments from the latest product showcase such as NAB, Comdex, IBC, or other smaller regional technology shows. In the past, this inventory has been a "best kept secret" for those smart buyers who found out where to get them. Now, Tektronix is making sure that everyone has the chance to get in on these outstanding purchase opportunities!

NEW PRODUCT PERFORMANCE

All products in the TekSelect program are serviced, calibrated and tested to meet the same high standards of quality that you've come to expect from Tektronix. All essential upgrades are installed and all products are functionally equivalent to brand new products. In other words, all TekSelect products meet full product specifications. That's our way of making sure that you don't have to sacrifice performance when purchasing a product from Tektronix.

All TekSelect Products are reconditioned by Tektronix-trained service engineers.

Another satisfied TekSelect customer.

ATTRACTIVE PRICES

Nowhere else can you buy direct from the factory at these savings. It's not uncommon for customers who purchase from the TekSelect program to comment on what an excellent deal they've made. This is our chance to help those customers whose budget constraints limit their ability to buy new. We take great pleasure in finding them a product that will do the job, at a price that won't break their budget. Contact your Account Manager, CSR, or one of our TekSelect reseller partners (listed below) for the latest price and availability on TekSelect inventory.

"UNHEARD-OF" NEW PRODUCT WARRANTY

While all TekSelect products are reconditioned, the warranty isn't! We provide each TekSelect product with a new product warranty. That's right! New Product Warranty!

This is by far one of the greatest TekSelect features. All TekSelect products have the same warranty as if the products were new. Extended service options are also available on most products. That's our commitment to ensure that you're not short-changed on one of the most important aspects of buying reconditioned inventory, the product's warranty!

OUTSTANDING APPEARANCE

You've heard how our TekSelect products perform to new product standards. You've heard how we provide all TekSelect products with a new product warranty. You're now aware that our prices on TekSelect products are outstanding and provide you a substantial savings. Now it's important to know that while all TekSelect products are reconditioned, many times they're very difficult to distinguish from new. These are not seconds! They look as good as they run...outstanding!

AVAILABILITY/DELIVERY

When you have a special project with tight deadlines, waiting for an instrument simply won't do. TekSelect can help you! In most cases, products have been reconditioned in advance, and are available immediately. TekSelect products are offered on a "first come first serve" basis. Hurry! Call your Account Manager, CSR, or one of our TekSelect reseller partners today for availability and delivery information.

TekSelect Resellers:

AT&T Capital Corporation Instrument & Data Services
1-800-874-7123

Continental Resources, Inc.
1-800-937-4688

McGrath RentCorp
1-800-352-2900

McGrath RenTelco
1-800-233-5807

Telogy, Inc.
1-800-835-6494

Test Equity
1-800-673-3457

Test Equipment Connection
1-800-615-8378

Tucker Electronics
1-800-527-4642

Training and Seminars

For Users and Service Technicians

Features

MEASUREMENT CUSTOMER TRAINING OFFERINGS:

- Measurement Product Service Training
- Measurement User and Measurement Techniques Workshops
- Measurement Self-study Material
  - Self-study Packages
  - Videotapes
  - Audiotapes
- Measurement Training Documentation
  - Instructor/Training Guides
  - Service Manuals
- Measurement Product and Technology Seminars

NOTE: Training and Seminar programs vary according to country. For information on programs in your location, contact your Tektronix representative (listed in the back of this catalog).

To register for formal training classes or for information on other training services, contact: Tektronix, Measurement Training, Walker Road Industrial Park. Attention: Measurement Training Registrar, P.O. Box 4600, M/S 94-925, Beaverton, OR 97076. Inside the U.S. phone: (800) 426-2200; at the prompt, press 3 and inquire about code 429.

Formal classroom training is available at the Tektronix training facilities in Beaverton, Oregon, as well as in Atlanta, GA; Boston, MA; Chicago, IL; Dallas, TX; Denver, CO; Irvine, CA; Santa Clara, CA; and Washington, D.C. On-site classes and workshops are also available upon request.

See Tektronix on the World Wide Web: http://www.tek.com

Measurement Product Service Training Classes

Professional training provides your technicians the opportunity to learn the latest maintenance techniques in the same courses used to train Tektronix technicians. We emphasize the "How to Fix" philosophy.

Our formal classroom training is intensive, with lectures and hands-on labs. Tektronix product service training instructors sharpen your skills in troubleshooting, isolating faults, and repairing Tektronix products. You learn factory-approved maintenance procedures for long product life and maximum uptime.

Customized on-site product service training is available. We have the flexibility within our programs to provide training at your location, enabling you to save costly travel expenses. By tailoring the class presentations and materials to your exact needs, you receive maximum value for your training investment.

INSTRUMENT USER AND MEASUREMENT TECHNIQUES WORKSHOPS

Maximize the efficient utilization of your Tektronix products by subscribing to one of the many Instrument User and Measurement Techniques Workshops offered by Tektronix Measurement Training. These workshops combine classroom lectures with plenty of hands-on labs that emphasize the "Make Measurements" philosophy.

These workshops may be conducted at your U.S. location and customized to satisfy your needs. This high quality training increases your productivity and provides you with the instrument familiarity necessary to excel in your profession. Tell us what you need and see what we can do for you. Call today: 1-800-835-9433 x WR1407.

SELF-STUDY MATERIALS

Study on the job or at home. We offer self-study video-/audiotapes and training packages which include exercises to help you quickly develop product familiarity and skills in fault diagnosis and repair.

Tektronix Measurement product user self-study training packages provide interactive, hands-on instruction for comprehension of product operation and applications. Measurement product service packages cover troubleshooting and repair techniques at your own bench. Our tapes are quality products that progress from basic

concept packages for novice technicians to advanced concept packages for experienced service specialists. Build your own library of relevant training tapes and materials. Training packages are the next best thing to being in class. Refer to page 430 for self-study package content and ordering information.

TRAINING DOCUMENTATION

Tektronix Measurement Training develops the complete program for your training needs. In addition to formal training, we can create for your use a complete instructor package consisting of class outline, lesson plan, instructor guide, student workbook, lab exercises, and visual projections. Service manuals, created by the Measurement Training group, can be developed to satisfy your specific needs. Our professional technical writers develop materials which emphasize the "How to Fix" techniques used by the Tektronix service specialist.

Our training programs have been used by various branches of the U.S. Armed Services with high acclaim. Join the team of professionals using training offered by Tektronix Measurement Training.

MEASUREMENT PRODUCT AND TECHNOLOGY SEMINARS

We want to support you in your need to stay on top of the rapid advances in technology. Tektronix offers a wide variety of seminars ranging from product specific seminars to test and measurement technology seminars. Learn about the latest technology advances in the test and measurement field. To receive information on seminars, call your local Tektronix sales office and have your name added to the seminar mail list.

Power Sources

Power Sources

Many products offered by Tektronix*1 provide wide-range regulated supplies, or quick change line-voltage selectors for convenient selection of line-voltage operating ranges. In a few instruments transformer taps can be changed to accommodate specific line-voltage operating ranges or, if specified on the purchase order, can be factory wired for a specific range.

Most Tektronix instruments are designed to operate from a power source that will not apply more than 250 Volts RMS between the supply conductors or between either supply conductor and ground.

For power cord/plug options not specified in this catalog, contact your local Tektronix representative for information. When ordering Opt. A1, Opt. A3, Opt. A5, Opt. A6, ask for export pricing.

Except for some double-insulated instruments, most Tektronix instruments are equipped with either a three conductor attached power cord or a three-terminal power cord receptacle. The third wire or terminal is connected directly to the instrument's chassis to protect operating personnel.

Power cord coding follows one of the two following schemes:

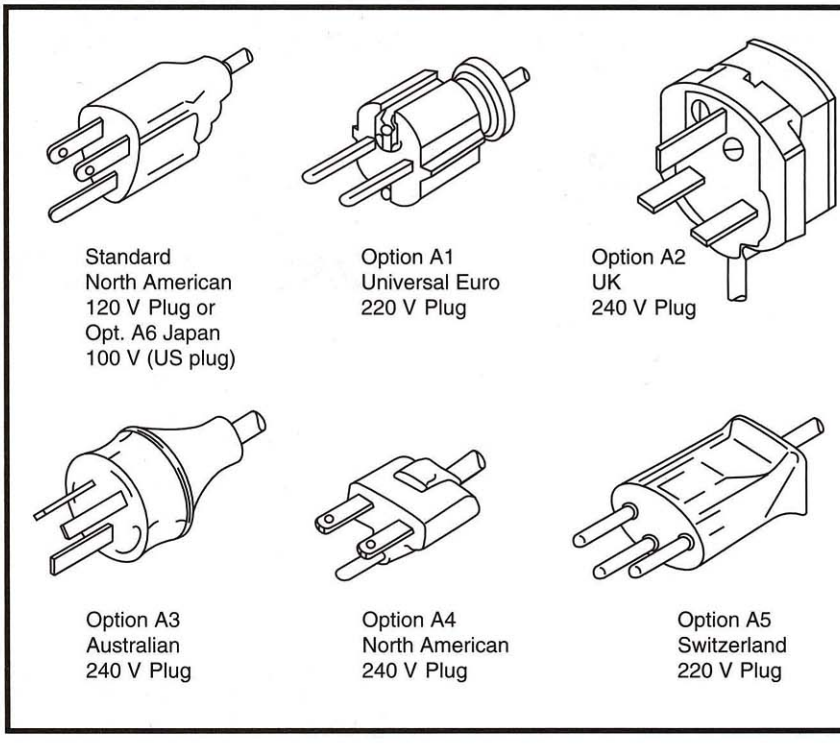
	Scheme 1	Scheme 2
Line	Black	Brown
Neutral	White	Light blue
Ground (safety earth)	Green-yellow	Green-yellow

POWER SOURCES

Many Tektronix instruments can be fitted with one of the power cord/plug options listed and wired for the voltage as indicated, if specified on the purchase order.

Standard	North American	120 V
Opt. A1	Universal Euro	220 V
Opt. A2	United Kingdom	240 V
Opt. A3	Australian	240 V
Opt. A4	North American	240 V
Opt. A5	Switzerland	220 V
Opt. A6	Japan	100 V

**1 These options are not available for Rohde & Schwarz or ADVANTEST products.*



Application/Technical Information

YOU NOW HAVE A FAST, CONVENIENT WAY TO OBTAIN APPLICATION/TECHNICAL INFORMATION FROM TEKTRONIX:

TEKFAX

- The TekFAX™ Instant Information System. Perfect for Information You Need Immediately.
- Tektronix Has a Full Library of Information to Support Your Needs.

TEKFAX Application/Technical Information Available Via FAX

Tektronix is pleased to provide 24 hour automated information service on over 200 of our fine measurement products.

Through your touch tone telephone, follow our voice-prompted selection process and immediately receive application information or specification data directly from your office or home fax machine.

This service reflects our commitment to deliver top value to you in all our products and services.

CALL TekFAX AT: 1-800-835-7732

To Receive:
Call TekFAX and

SELECT "1"
IF YOU KNOW THE DOCUMENT NUMBER YOU WISH TO RECEIVE

OR

SELECT "2"
FOR DOCUMENT INDEXES AND ENTER YOUR CHOICE FROM THE LIST TO THE RIGHT

Indexes with Application/Technical Information available through TekFAX:

1. Oscilloscope Solutions
2. Basic Instrumentation
3. Electronic Measurement Instruments
4. VXI Instruments
5. Digital Systems Development
6. Video and Audio Test
7. Communications Test
8. Customer Services and Company Information
9. Accessories and Other Products (Including Probes)

TO ACCESS TekFAX:

1. Call 1-800-835-7732 (from anywhere in the US or Canada).
2. Select "1" if you are familiar with TekFAX, "2" for an overview of how TekFAX works.
3. Select "1" if you know the document number you wish to receive.
4. Select "2" if you are calling to request a document index of choice (see list above).
5. After selecting the information you would like, you will be prompted to enter the fax machine number to which you want information sent.
6. Another prompt will allow you to indicate a phone extension number or name to ensure delivery of information if you have a multiple user fax machine.
7. TekFAX will process your request.

If you prefer personal service, call 1-800-426-2200. At the auto prompt press 3 and a representative will be available to assist you.

Worldwide Sales and Service Offices

Customers in South America, Central America and The Caribbean should contact Tektronix Export Sales

AaROW
Tektronix, Inc.
Export Sales
P.O. Box 500, M/S 50-228
Beaverton, OR 97077
USA
Phone: 1 (503) 627-6877
Fax: 1 (503) 627-6905

For customers in areas not listed:

Eastern Europe

Tektronix Ges.m.b.H.
Triester Straße 14
A-2351 Wiener Neudorf
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

Customers in Near- and Middle East should contact:
Werner Mueller in the office in Austria.

Tektronix Ges.m.b.H.
Triester Straße 14
A-2351 Wiener Neudorf

AFRICA

Customers in Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Djibouti, Equatorial Guinea, Gabon, Guinea, Ivory Coast, Malagasy, Mali, Mauritius, Monaco, Niger, Senegal, Togo, Zaire should contact:

Tektronix S.A., France
Courtaboeuf 1
Parc Technopolis-
Bât. Oméga
3, avenue du Canada
91941 Les Ulis Cedex
France
Phone: 33 1 69 86 81 81
Fax: 33 1 69 07 09 37

ALBANIA

Rohde & Schwarz Repräsentanz
Kopiska 92
Ljubljana
SLO-1000
Slovenia
Phone: (386) 61-1234651, 1234661
Fax: (386) 61-1234611

ALGERIA

Customers in Algeria should contact:

Tektronix S.A., France
Courtaboeuf 1
Parc Technopolis-
Bât. Oméga
3, avenue du Canada
91941 Les Ulis Cedex
France
Phone: 33 1 69 86 81 81
Fax: 33 1 69 07 09 37

ARGENTINA

Coasin S.A.C.I. y F.

Buenos Aires Office
Virrey del Pino 4071
Buenos Aires
1430
Argentina
Phone:
54 (1) 552-3485/551-9361
Int'l Fax: 54 (1) 555-3321

AUSTRALIA

Tektronix Australia Pty. Limited

Sydney
80 Waterloo Road
North Ryde
N.S.W.
2113
Australia
Phone: 61 (2) 9888-0100
Fax: 61 (2) 9888-0125

Tektronix Australia Pty. Limited

Adelaide/Northern Territory
128 Gillies Street
Adelaide
South Australia
5000
Phone: 61 (8) 8223-2811
Fax: 61 (8) 8223-7890

Brisbane/Papua New Guinea
Suite 2
290 Boundary Street
Spring Hill
Queensland
4000
Phone: 61 (7) 3839-9551
Fax: 61 (7) 3839-9560

Canberra/A.C.T.
Unit 4
9-11 Napier Close
Deakin
A.C.T.
2600
Phone: 61 (6) 282-3191
Fax: 61 (6) 282-3292
For Measurement Sales Enquiries Only:
1 800 023342

Melbourne/Tasmania
259 Whitehorse Rd.
Balwyn
Victoria
3103
Phone: 61 (3) 9836 3355
Fax: 61 (3) 9836 6592

Western Australia Control Dynamics
(Tektronix Australia Representative)

Perth
5 Bookham St
Morley
Western Australia
6062
Phone: 61 (8) 9275 9700
Fax: 61 (8) 9275 9717

AUSTRIA

Tektronix Ges.m.b.H.
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

BAHRAIN

International Agencies Co. Ltd.
Ali Al-Wazzan Building
131, Afkhalifa Ave.
P.O. Box 584
Bahrain
Phone: 973-727-177
Fax: 973-727-228

BANGLADESH

Customers in Bangladesh should contact the Tektronix office in Bangalore, India.

Tektronix (India) Limited

Bangalore Office (Corporate Office)
Tek Tower, Hayes Road
Bangalore
560 025
India
Phone: (91) 80-2275577
Fax: (91) 80-2275588

BELGIUM

Tektronix nv/sa

Brussels
Bedrijfspark Keiberg
Excelsiorlaan, 3
1930 Zaventem
Belgium
Phone: 32 (2) 715.89.70
Fax: 32 (2) 725-99-53

BOLIVIA

Coasin Bolivia S.R.L.
Calle Ayacucho No. 208
Edificio Flores 5o Piso
Casilla 7295
La Paz, Bolivia
Phone: 591 (2) 317531
Fax: 591 (2) 317-545

BRAZIL

Tektronix Industria e Comercio Ltda

São Paulo Head Office
Centro Empresarial de São Paulo
Av. Maria Coelho Aguiar, 215 - Bloco D - 1o Andar
São Paulo
SP
05805-000
Brasil
Phone (Sales):
55 (11) 3741-8360
Fax (Sales):
55 (11) 3741-7358
Phone (Service):
55 (11) 3741-8417
Fax (Service):
55 (11) 548-0701

Tektronix Industria e Comercio Ltda

Rio de Janeiro Office
Praia de Botafogo no 518, 2o andar
Botafogo, Rio de Janeiro
RJ
22250-040
Brasil
Phone: 55 (21) 541-9755
Fax: 55 (21) 542-3589

BRUNEI

Customers in Brunei should contact the Tektronix office in Singapore.

Tektronix Singapore Pte. Ltd.
101 Thomson Road
#02-02
United Square
307591
Singapore
Phone: (65) 356-3900
Fax: (65) 356-4483

BULGARIA

Rohde & Schwarz Osterreich Ges.m.b.H.
Representation Office
Bulgaria
39, Fridtjof Nansen Blvd.
BG-1000 Sofia
Bulgaria
Phone: 359 (2) 652 443, 655133
Fax: 359 (2) 656 833

CANADA

Tektronix Canada, Inc.

Montreal
890 Selkirk Street
Pointe Claire
Quebec H9R 3S3
Phone: (514) 697-5340
Fax: (514) 697-5205

Tektronix Canada, Inc.

Ottawa
555 March Road
Kanata
Ontario K2K 2M5
Phone: (613) 599-4511
Fax: (613) 599-4513

Tektronix Canada, Inc.

Toronto/Western Canada
785 Arrow Road
Weston
Ontario M9M 2L4
Phone: (416) 747-5000
Fax: (416) 747-9799

Tektronix Canada, Inc.

Vancouver
8666 Commerce Court
Burnaby
B.C. V5A 4N7
Phone: (604) 420-2787
Fax: (604) 420-2759

Tektronix Canada Inc.

Calgary
Suite 174
6815 8th Street NE
Calgary
Alberta T2E 7H7
Phone: (403) 274-2691
Fax: (403) 274-3483

CHILE

AVANTEC LTDA.
(Test and Measurement, TV, and Telecom)
Fidel Oteiza 1921 of. 1106
Providencia
Santiago
Chile
Phone: 56 (2) 341-1021
Fax: 56 (2) 341-1020

COLOMBIA

Selectronica, Ltda.
Carrera 71 #55-98
Mail: Apartado Aereo 25125
Santa fé de Bogota
D.C.
Phone: 57 (1) 263-1220, 295-3215
Fax: 57 (1) 263-2874

CROATIA

Tescom
Gunduliceva br. 41
Zagreb
HR-10000
Croatia
Phone: (385) 1-417080, -448676
Fax: (385) 1-442273

CYPRUS

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.

Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: +43 1 70177-261
Fax: +43 1 701 77-260

CZECH REPUBLIC AND SLOVAK REPUBLIC

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Wiener Neudorf
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

DENMARK

Tektronix A/S
Tonsbakken 16-18
Skovlunde
DK-2740
Denmark
Phone: 45 (44) 850 700
Fax: 45 (44) 850 701

ECUADOR

Proteco Coasin Cia Ltda.

Quito Office
Ave. 12 de Octubre 2449 y Orellana
Casilla 228-A
Quito
Phone: 593 (2) 52-6759
Fax: 593 (2) 56-1980

Electrolab Ltda.
(TV Products)
Av. Juan Tanca Marengo #200
PO Box 09-01-1233
NEED PHONE NUMBER

Guayaquil
Phone: 593 (4) 291456
Fax: 593 (4) 286602
NEED ADDRESS

EGYPT

Giza Systems Engineering Co.
2, Mesaha Square.
Dokki,
P.O. Box 1913
Cairo
11511
Egypt
Phone: 20 (2) 349 0140
Fax: 20 (2) 360 9932
Fax: 20 (2) 3499253
Telex: 93644 ALKAN UN

Worldwide Sales and Service Offices

ESTONIA

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

FINLAND

Tektronix Oy
Piispantilankuja 2
02240 Espoo
Finland
Phone: 358 (9) 4783 400
Fax: 358 (9) 4783 4200

FRANCE

Tektronix S.A., France
Courtaboeuf 1
Parc Technopolis-
Bât. Oméga
3, avenue du Canada
91941 Les Ulis Cedex
France
Phone: 33 1 69 86 81 81
Fax: 33 1 69 07 09 37

GERMANY, FEDERAL REPUBLIC OF

Tektronix GmbH
Cologne - Vertriebszentrale
Deutschland
Stolberger Strasse 200
D - 50933 Köln
Germany
Phone: 49 (221) 94 77 400
Fax: 49 (221) 94 77-333

Tektronix GmbH
European Headquarters
Fraunhoferstraße 9-11
D - 85737 Ismaning
Germany
Phone:
49 (89) 96 24 05-16
Fax: 49 (89) 96 25 05-10

GREECE

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: +43 1 70177-261
Fax: +43 1 701 77-260

HONG KONG

Tektronix Hong Kong, Ltd.
22nd Floor,
Dah Sing Financial Ctr.
108 Gloucester Road
Wanchai
Hong Kong
Phone: (852) 2585-6688
Fax: (852) 2598-6260
Cable: TEKHKGLTD
Telex: 77708 DCBIA HX

HUNGARY

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

INDIA

Tektronix (India) Limited

Bangalore Office (Corporate Office)
Tek Tower, Hayes Road
Bangalore
560 025
India
Phone: (91) 80-2275577
Fax: (91) 80-2275588

Mumbai Office
Ground Floor
Dinanath Mangeshkar Hall
Tejpal Road,
Vile Parle (East)
Mumbai
400 057
India
Phone: 91 (22) 6182727
Fax: 91 (22) 6175794

Calcutta Office
21, 4th Floor
Kohinoor Building
105, Park Street
Calcutta
700 016
India
Phone: 91 (33) 2269953,
2262571, 2260322
Fax: 91 (33) 2269953

Chennai Office
203, 2nd Floor
Prince Centre
709/710, Mount Road
Chennai
600 006
India
Phone:
91 (44) 8526407, 8550339
Fax: 91 (44) 8550286

New Delhi Office
22, 6th Floor
Dakshineshwar
10, Hailey Road
New Delhi
110 001
India
Phone: 91 (11) 3352633,
3354256, 3354257
Fax: 91 (11) 3352738

Secunderabad Office
H-6A, 5th Floor
Minerva Commercial
Complex
94, Sarojini Devi Road
Secunderabad
500 003
India
Phone: 91 (40) 817383,
867249
Fax: 91 (40) 817383

INDONESIA

P.T. Cosmotec Sarana Elektronika Indonesia
Jalan Jembatan Dua
Komplek Ruko Harmoni
Mas Blok
A-15
Jakarta Utara
(14450)
Indonesia
Phone: (6221)6670011
Fax: (6221)6670020

ISRAEL

Eastronics Ltd
P.O. Box 39300
Tel Aviv
61392
Phone: 972 (3) 645-8777
Fax: 972 (3) 645-8666

ITALY

Tektronix S.p.A.
Milan
Via XI Febbraio, 99
20090 Vimodrone (MI)
Italy
Phone: 39 (2) 25086.1
Fax: 39 (2) 39 2 25086500

JAPAN

Sony/Tektronix Corporation

Headquarters
5-9-31 Kitashinagawa,
Shinagawa-ku,
Tokyo
141
Phone: 81 (3) 3448-3111
Fax: 81 (3) 3444-3663
Telex:
(781) 2422850 STTYO J

Atsugi
Pastoral Bldg.
1-8-6 Asahi-cho,
Atsugi-shi,
Kanagawa
243
Phone: 81 (462) 28-6768
Fax: 81 (462) 28-8043

Chiba
Taiso Center Bldg.
2-7-2 Shinchiba,
Chuo-ku,
Chiba 260
Phone: 81 (43) 242-1911
Fax: 81 (43) 242-2291

Fukuoka
Nihon Seimei
Hakataekimae Bldg.
3-2-1 Hakataekimae,
Hakata-ku,
Fukuoka 812
Phone: 81 (92) 472-2626
Fax: 81 (92) 472-2627

Hiroshima
Hiroshima Intes
10-10 Hashimoto-cho,
Naka-ku
Hiroshima 730
Phone: 81 (82) 222-7221
Fax: 81 (82) 222-7225

Kyoto
Recruit Meijiseimei Bldg.
Karasumaoike,
Nakagyo-ku,
Kyoto 604
Phone: 81 (75) 212-2990
Fax: 81 (75) 212-2993

Matsumoto
Design Center Bldg.
1096-1 Shimadate,
Matumoto-shi,
Nagano 390
Phone: 81 (263) 48-2211
Fax: 81 (262) 48-2110

Nagoya
Sanko Building
3-21-7 Meieki,
Nakamura-ku
Nagoya-shi,
Aichi 450
Phone: 81 (52) 581-3547
Fax: 81 (52) 563-7637

Omiya
Omiya Sawada Bldg.
1-12-5 Sakuragicho,
Omiya-shi,
Saitatma 331
Phone: 81 (48) 646-0711
Fax: 81 (48) 646-0859

Osaka
Osaka Ohbayashi Bldg.
4-33 Kitahama-Higashi
Chuo-ku,
Osaka 540
Phone: 81 (6) 947-0321
Fax: 81 (6) 941-3861

Sendai
Sendai NS Bldg.
1-2-25 Ichibancho,
Aoba-ku,
Sendai-shi,
Miyagi 980
Phone: 81 (22) 267-2181
Fax: 81 (22) 262-3290

Tama
2-45-10 Fujimidai,
Kunitachi-shi,
Tokyo 186
Phone: 81 (425) 73-2111
Fax: 81 (425) 73-2170

Tsuchiura
Sumitomo Seimei
Tsuchiura Bldg.
1-16-12 Sakuracho,
Tsuchiura-shi,
Ibaragi 300
Phone: 81 (298) 24-2602
Fax: 81 (298) 24-2606

Yokohama
Dai-ichi Yamashitacho
Bldg.
74-1 Yamashitacho,
Naka-ku,
Yokohama-shi,
Kanagawa 231
Phone: 81 (45) 661-3511
Fax: 81 (45) 661-3519

JORDAN

TekSignals
8th Floor, Suite no. 81
GIBCA Building
P.O. Box 47520
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971 (2) 343401
Fax: 971 (2) 327069
Telex: 24325 MDSUAE EM

KUWAIT

Tareq Company Ltd.
P.O. Box 20506
Safat
13066
Kuwait
Phone: 965 () 243-6100
Fax: 965 () 243 7700
Telex:
(496) 22315 ZUAITER KT

LATVIA

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

LEBANON

TekSignals
8th Floor, Suite no. 81
GIBCA Building
P.O. Box 47520
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971 (2) 343401
Fax: 971 (2) 327069
Telex: 24325 MDSUAE EM

LIECHTENSTEIN

Customers in Liechtenstein should contact the Tektronix office in Switzerland:

Tektronix International AG
Gubelstrasse 11
CH-6302 Zug
Schweiz
Phone: 41 (41) 7119192
Fax: 41 (41) 7117784

LITHUANIA

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

LUXEMBOURG

Customers in Luxembourg should contact the Tektronix office in Belgium:

Tektronix nv/sa
Brussels
Bedrijfspark Keiberg
Excelsiorlaan, 3
1930 Zaventem
Belgium
Phone: 32 (2) 715.89.70
Fax: 32 (2) 725-99-53

MALAYSIA

TekMark Sdn. Bhd.

Kuala Lumpur Office
No.2 Jalan Radin Anum
2Sri Petailing
Kuala Lumpur
57000
Malaysia
Phone: 60 (3) 957 8999
Fax: 60 (3) 957 3999

Penang Office
No. 46, 1st Floor,
Jalan Tengah,
Bayan Baru,
Penang
11950
Malaysia
Phone: 60 (4) 641-4298
Fax: 60 (4) 641-4299

MALTA

Itec International Technology Ltd.
B'Kara Road
San Gwann
SGN08
Malta
Phone: 356 374 300,
374 329
Fax: 356 374 353

MEXICO

Tektronix S.A. de C.V.
Periférico Sur 5000,
8ava Piso
Col. Insurgentes Cuicuilco
Del Coyoacan
Mexico
D.F.
04530
Mexico
Phone: 52 (5) 666-6333
Fax: 52 (5) 666-6336

Worldwide Sales and Service Offices

MOROCCO

Tradec-Signal
Place Khaibar
Angle Bd de la Gironde et
Rue d'Ifni
Casablanca 03
Morocco
Phone: 212 (2) 24 85 43
Fax: 212 (2) 24 85 66
Telex: 25992

NEPAL

Customers in Nepal should contact the Tektronix office in Bangalore, India.

Tektronix (India) Limited

Bangalore Office (Corporate Office)
Tek Tower, Hayes Road
Bangalore
560 025
India
Phone: (91) 80-2275577
Fax: (91) 80-2275588

THE NETHERLANDS

Tektronix Holland, N.V.
Planetenweg 93
2132 HL Hoofddorp
Postbus 406
2130 AK Hoofddorp
The Netherlands
Phone: 31 23 56 95555
Fax: 31 23 56 95500

NEW ZEALAND

Datamatic Networks, Ltd.

Wellington Office
Level 1 Siemens House
265 Wakefield Street
PO Box 11-692
Wellington
New Zealand
Phone: 64 (4) 384-7792
Fax: 64 (4) 384-7334

Auckland Office
21 William Pickering Dr.
North Harbour Industrial Estate
Mail: P.O. Box 33-326,
Takapuna, Auckland
Albany
Auckland
New Zealand
Phone: 64 (9) 415-6928
Fax: 64 (9) 415-6939

General Communications Ltd.

Wellington Office
189 Willis Street
Mail: PO Box 27042
Wellington
New Zealand
Phone: 64 (4) 801 7138
Fax: 64 (4) 801 7262

Auckland Office
Unit 1, 9-11 Rothwell Ave.
Mail: P.O. Box 100-070
Albany
Auckland
New Zealand
Phone: 64 (9) 415 6490
Fax: 64 (9) 415 6480

For Information on Tektronix Colour Printers only, contact:

Datamatic Limited

Auckland
Phone: 64 (9) 415 6928

Wellington
Phone: 64 (4) 384 7792

NORWAY

Tektronix Norge A/S
Brobekkveien 40
0583 Oslo
Norway
Phone: 47 (22) 070700
Fax: 47 (22) 070707

OMAN

TekSignals
8th Floor, Suite no. 81
GIBCA Building
P.O. Box 47520
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971 (2) 343401
Fax: 971 (2) 327069
Telex: 24325 MDSUAE EM

PAKISTAN

Pakland Corporation (Pvt) Ltd.
T & M Biz Division
Unit No. 8, 2nd Floor
Mohammadi Plaza,
Jinnah Avenue
Blue Area, F-6/G-6
Islamabad 44000
Pakistan
Phone: 92-51-826459
Fax: 92-51-826448

PARAGUAY

Eberhard Lewkowitz SRL
CC523 Paraguari 935
Asuncion
Paraguay
Phone: 595 (21) 44-4400
Fax: 595 (21) 44-4437

PEOPLE'S REPUBLIC OF CHINA

Tektronix China

Beijing Office
Room 101, Tong Heng Mansion,
No. 4, Hua Yuan Rd.,
Haidian District,
Beijing
Postal code: 100088
P.R.C.
Phone: 86 (10) 6235 1230
Fax: 86 (10) 6235 1236,

Shanghai Office
Room 614/616,
Shanghai Convention Centre
500 Zhao Jia Bang Road
Shanghai
Postal code: 200031
P.R.C.
Phone: 86 (21) 6471-0330
Fax: 86 (21) 6471 0282

Chengdu Office
Rm 411, 413, Tian Ge Building Mozi Bridge,
South 2nd Section,
First Ring Road,
Chengdu
Sichuan
Postal code: 610041
P.R.C.
Phone: 86 (28) 558-6770
Fax: 86 (28) 554-4631

Guang Zhou Office
Rm 1014, Yi An Plaza,
38 Jianshe Liu Ma Lu,
Guangzhou
Postal code: 510060
P.R.C.
Phone: 86 (20) 8387 5108
Fax: 86 (20) 8384 2950

Xian Office
Hyatt Regency Hotel,
Dong Da Jie,
Xian
Postal Code: 710001
P.R.C.
Phone: 86 (29) 723 1234
Ext. 8345
Fax: 86(29)723 1794

Wuhan Office
Rm 9, 9/F, Asia Trade Plaza
No 628 Wu Luo Road,
Wuchang
Wuhan
Hubei
Postal Code: 430070
P.R.C.

Asia Support Group

U.S. Office
P.O. Box 500, M/S 78-565
Delivery: 78-565
Beaverton,Oregon
97077
U.S.A
Phone: (503) 627-6563
Fax: (503) 627-6611
Telex: 192825

PERU

Importaciones y Representaciones Electronicas S.A.
IRE Ingenieros, S.A.
Jr. Pumacahua 955
Jesus Maria
Lima
11
Peru
Phone: 51 (14) 32-5099
Fax: 51 (14) 31-0707

PHILIPPINES

Philippine Electronic Industries, Inc.
Tito Jovy Building #2,
Buencamino Street,
Alabang
Muntinlupa
Metro Manila
Philippines
Phone: 63 (2) 842-5443,
63 (2) 805-7455
Fax: 63 (2) 802-3518

Broadcast and Communication Company of Asia, Inc.
(TV Products Only)
R-1902A Tektite Tower II
Exchange Rd.,
Ortigas Center
Pasig City
Metro Manila
Philippines
Phone: 632-6311177
Fax: 632-6311861

POLAND

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

RSM SERVICE
Tespol
ul. Tarnogajska 11/13
PL-50-950 Wroclaw
Poland
Phone: 48 (71) 673893
Fax: 48 (71) 673893
Telex: 863 712357

PORTUGAL

Decada Medida, SA
Taguspark
Edificio Tecnologia III, 54
2780 Oeiras
Portugal
Phone: 351 (1) 4210111
Fax: 351 (1) 4211213

QATAR

TekSignals
8th Floor, Suite no. 81
GIBCA Building
P.O. Box 47520
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971 (2) 343401
Fax: 971 (2) 327069
Telex: 24325 MDSUAE EM

REPUBLIC OF IRELAND

Customers in the Republic of Ireland should contact the Tektronix office in the United Kingdom:

Tektronix U.K. Limited
Fourth Avenue
Globe Park
Marlow
Bucks
SL7 1YD
United Kingdom
Phone: 44(0)1628 403300
Fax: 44 (0)1628 403301

REPUBLIC OF KOREA

Tektronix Korea, Ltd.

Kumi Office
1074, Wonpyoung-Dong
Kumi City
Kyoungbuk Province
730-010
Korea
Phone: 82 (546) 456-0966
Fax: 82 (546) 456-9005

Taejon Office
17th Flr. Yusung Hanjin Officetel
535-5, Bongmyung-Dong
Yusung-Gu
Taejeon City
305-301
Korea
Phone: 82 (42) 822-6701
Fax: 82 (42) 822-9468

Seoul Head Office
7 - 8th Floor, Ilsong Bldg.
157-37 Samsung-Dong
Kangnam-Gu
Seoul
135-090
Korea
Phone: 82 (2) 528-0709
Fax: 82 (2) 528-0740
Service Center Direct
Phone: 82 (2) 528-4664

ROMANIA

Rohde & Schwarz
Representation Office
Bucharest
Str. Uranus 98
Sc 2, Et 5, Ap. 36
Bucuresti, Sector 5
RO-76102
Romania
Phone: 40 (1) 4112013
Fax: 40 (1) 4112013

Vega Electronics SRL
Local Service Representative:
Str. Alexandru cel Bun 14
BL T22, Ap.1
R-72238
Bucursti, Sector 2
Romania
Phone: 40 (1) 3128935
Fax: 40 (1) 3128935
Telex: 865/10076

RUSSIA

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

SAUDI ARABIA

Electronic Equipment Marketing Co. (EEMCO)
P.O. Box 3750
Riyadh
11481
Saudi Arabia
Phone: 966 (1) 477 1650
Fax: 966 (1) 478 5140
Telex:
(928) 401120 ZUHAIR SJ

SINGAPORE

Tektronix Southeast Asia Pte. Ltd.
101 Thomson Road
#02-02
United Square
307591
Singapore
Phone: (65) 356-3900
Fax: (65) 356-4483

SLOVENIA

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

Danipac Trzin d.o.o.
Distributor:
Kidriceva 49 Trzin
SLO-1234 Menges
Slovenia
Phone: (386) 61-711683
Fax: (386) 61-711683

TMM Servis
Local Service Representative:
C.V.Gorice 38
SLO-1000 Ljbljana
Slovenia
Phone: 386 (61) 1232399
Fax: 386 (61) 1232399

SPAIN

Madrid

Tektronix Española S.A.
Proción, 1-3
La Florida
28023 Madrid
Spain
Phone: 34 (1) 372 6000
Fax: 34 (1) 372 6049

Worldwide Sales and Service Offices

Barcelona
Tektronix Española S.A.
Marques de Sentmenat, 54
08029 Barcelona
Spain
Phone: 34 (3) 405.1516
Fax: 34 (3) 410.9370

SRI LANKA

Customers in Sri Lanka should contact the Tektronix office in Bangalore, India.

Tektronix (India) Limited
Bangalore Office (Corporate Office)
Tek Tower, Hayes Road
Bangalore
560 025
India
Phone: (91) 80-2275577
Fax: (91) 80-2275588

SWEDEN

Tektronix AB
Stockholm
Box 20085
Adolfsbergsvägen 31
S-161 02 Bromma
Sweden
Phone: 46 (8) 629 6503
Phone: 46 (8) 629 6504
Fax: 46 (8) 629 6540

SWITZERLAND

Tektronix International AG
Zug
Gubelstrasse 11
CH-6302 Zug
Schweiz
Phone: 41 (41) 7119192
Fax: 41 (41) 7117784

SYRIA

TekSignals
8th Floor, Suite no. 81
GIBCA Building
P.O. Box 47520
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971 (2) 343401
Fax: 971 (2) 327069
Telex: 24325 MDSUAE EM

TAIWAN

Tektronix Taiwan, Ltd.
Taipei Office
8th Floor, No.2
Hsin Yi Road, Sec. 5
Taipei
110
Taiwan, R.O.C.
Phone: 886 (2) 722-9622
Fax: (Main)
886 (2) 722-2822

Hsinchu Office
15F-5, No. 295
Kuang Fu Road, Sec. 2
Hsinchu
300
Taiwan, R.O.C.
Phone: 886 (3) 573-6627
Fax: 886 (3) 572-6700

Kaohsiung Office
18th Floor, No.12,
Po-Ai 3rd Road
Tso-Ying District,
Kaohsiung
813
Taiwan, R.O.C.
Phone: 886 (7) 345-8251
Fax: 886 (7) 345 8165

THAILAND

Trinergy Instrument Co. Ltd
200/6 Soi Ramkhamhaeng 4
Suanluang, Suanluang
Bangkok
10250
Thailand
Phone: 66 (2) 318-4670-1, 719-9060
Fax: 66 (2) 318-4 673

TUNISIA

Societe El Eslek
3 Rue Hedi Novira
Tunis
1001
Tunisia
Phone: 216 (1) 347 456
Fax: 216 (1) 342003
Telex:
(934) 13664 ESLEK TN

TURKEY

Inter Mühendislik Danismanlik Ve Ticaret A.S.
Hasircibasi CAD No. 55
81300 Kadiköy
Istanbul
Turkey
Phone: 90 216 349 9400
Fax: 90 216 349 9432

UKRAINE

Customers should contact:
Werner Mueller

Tektronix Ges.m.b.H.
Vienna
Triester Straße 14
A-2351 Wiener Neudorf
Austria
Phone: 43 (1) 701 77261
Fax: 43 (1) 701 77260

UNITED ARAB EMIRATES

TekSignals
8th Floor, Suite no. 81
GIBCA Building
P.O. Box 47520
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971 (2) 343401
Fax: 971 (2) 327069
Telex:
24325 MDSUAE EM

UNITED KINGDOM

Tektronix U.K. Limited
Fourth Avenue
Globe Park
Marlow
Bucks
SL7 1YD
United Kingdom
Phone: 44(0)1628 403300
Fax: 44 (0)1628 403301

UNITED STATES

ALABAMA

Huntsville
4970 Corporate Drive
Suite 100A
Huntsville 35805
Phone: (205) 830-9212
Fax: (205) 837-2666

ALASKA

Served by the Seattle, Washington Field Office
Phone: (206) 644-1001
Fax: (206) 644-1055
For Orders:
(800) 835-3553

ARIZONA

Phoenix
410 N. 44th Street,
Suite 175
Phoenix 85008
Phone: (602) 225-2542
Toll Free: (800) 366-8358
Fax: (602) 225-9615
For Orders:
(800) 538-8125

ARKANSAS

Served by the Dallas, Texas Field Office
Phone: (972) 401-1666
Fax: (972) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525
Service Fax:
(972) 401-0227

CALIFORNIA (NORTH)

Santa Clara
3003 Bunker Hill Lane
Santa Clara 95054
Phone: (408) 496-0800
Fax: (408) 988-6051
For Orders:
(800) 538-8125
Mailing Address:
P.O. Box 58086
Santa Clara 95052-8086

CALIFORNIA (SOUTH)

Irvine
27 Technology Drive,
Suite 110
Irvine 92718
Phone: (714) 789-7200
Toll Free: (800) 255-2958
Fax: (714) 789-7220
For Orders:
(800) 538-8125

COLORADO

Denver
61 Inverness Drive East
Suite 206
Englewood 80112
Phone: (303) 799-1000
Fax: (303) 790-4754
Toll Free: (800) 543-6097
Service: (800) 334-0525

DISTRICT OF COLUMBIA

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

CONNECTICUT

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

DELAWARE

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

FLORIDA

Orlando
151 Southhall Lane
Suite 170
Maitland 32751
Phone: (407) 660-2727
Fax: (407) 660-8585
Service: (407) 660-8747
Service Fax:
(407) 660-8747

Pensacola
1101 Gulf Breeze Pky.
Suite 211
Gulf Breeze 32561
Phone: (904) 932-4080
Fax: (904) 932-5642

GEORGIA

Atlanta
3475 Corporate Way,
Suite A
Duluth 30136
Phone: (770) 622-5822
Fax: (770) 622-5823

HAWAII

Served by the Irvine, California Field Office
Phone: (714) 789-7200
Toll Free: (800) 255-2958
Fax: (714) 789-7220
For Orders:
(800) 538-8125

IDAHO

Served by the Seattle, Wahington Field Office
Phone: (206) 644-1001
Fax: (206) 644-1055
For Orders:
(800) 835-3553

ILLINOIS

Chicago
515 West Algonquin Road
Suite 100
Arlington Heights 60005
Phone: (847) 364-0022
Sales: (800) 458-7587
Service: (800) 535-5705
Service Fax:
(847) 364-7587
CPID Sales Fax:
(847) 364-7618
GVG Sales Fax:
(847) 364-7582
Sales Fax: (847) 364-7584

INDIANA

Served by the Chicago, Illinois Field Office
Phone: (847) 364-0022
Sales: (800) 458-7587
Service: (800) 535-5705
Service Fax:
(847) 364-7587
CPID Sales Fax:
(847) 364-7618
GVG Sales Fax:
(847) 364-7582
Sales Fax: (847) 364-7584

IOWA

Served by the Chicago, Illinois Field Office
Phone: (847) 364-0022
Sales: (800) 458-7587
Service: (800) 535-5705
Service Fax:
(847) 364-7587
CPID Sales Fax:
(847) 364-7618
GVG Sales Fax:
(847) 364-7582
Sales Fax: (847) 364-7584

KANSAS

Served by the Dallas, Texas Field Office
Phone: (972) 401-1666
Fax: (972) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525
Service Fax:
(972) 401-0227

KENTUCKY

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service:(301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

LOUISIANA

Served by the Dallas, Texas Field Office
Phone: (972) 401-1666
Fax: (972) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525
Service Fax:
(972) 401-0227

MAINE

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

MARYLAND

DC
700 Professional Drive
Suite A
Gaithersburg 20879
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

MASSACHUSETTS

Boston
125 Hartwell Avenue
Lexington 02173
Phone: (617) 861-6800
Fax: (617) 863-5994
Toll Free: (800) 545-8408

MICHIGAN

Detroit
39555 Orchard Hill Place
Suite 525
Novi 48375
Phone: (248) 348-9070
Fax: (248) 348-4819

Worldwide Sales and Service Offices

MINNESOTA

St. Paul
8 Pine Tree Drive
Suite 140
Arden Hills 55112
Phone: (612) 481-3297
Fax: (612) 481-1735

MISSISSIPPI

Served by the Dallas, Texas Field Office
Phone: (972) 401-1666
Fax: (972) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525
Service Fax:
(972) 401-0227

MISSOURI

St. Louis
12400 Olive Blvd.
Suite 555
St. Louis 63141-5439
Phone: (314) 275-4471
Fax: (314) 523-4525

MONTANA

Served by the Seattle, Washington Field Office
Phone: (206) 644-1001
Fax: (206) 644-1055
For Orders:
(800) 835-3553

NEVADA

Served by the Santa Clara, California Field Office
Phone: (408) 496-0800
Fax: (408) 988-6051
For Orders:
(800) 538-8125

NEBRASKA

Served by the Dallas, Texas Field Office
Phone: (972) 401-1666
Fax: (972) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525
Service Fax:
(972) 401-0227

NEW HAMPSHIRE

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

NEW JERSEY

Woodbridge
485 Route One, Building C
Suite 190
Iselin 08830
Phone: (908) 283-8111
Fax: (908) 283-4711

NEW YORK

Albany
125 Wolf Road
Suite 503-7
Albany 12205
Phone: (518) 458-7291
Fax: (518) 458-7361

Rochester
1160 Pittsford-Victor Road
Suite D
Pittsford 14534
Phone: (716) 383-0070
Fax: (716) 383-0022
Service:(716) 383-0070

NORTH CAROLINA

Raleigh
110 Corning Road,
Suite 130
Cary 27511
Phone: (919) 233-7999
Fax: (919) 233-3433

NORTH DAKOTA

Served by the St. Paul, Minnesota Field Office
Phone: (612) 481-3297
Fax: (612) 481-1735

OHIO

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

OKLAHOMA

Served by the Dallas, Texas Field Office
Phone: (972) 401-1666
Fax: (972) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525
Service Fax:
(972) 401-0227

OREGON

Portland
Sales:
Mailing Address:
M/S 50-PTLD
P.O. Box 500
Beaverton 97077-0001
For Orders:
(800)835-3553

OREGON

Shipping Address:
M/S 50-PTLD
Regional Distr. Ctr.
Beaverton 97077
Phone: (503) 627-7999
Fax: (503) 627-7995
Toll Free: (800) 621-1966
Toll Free Service:
(800) TEK-WIDE Ext. 6630
Service Phone:
(503) 627-6630
Service Fax:
(503) 627-6576

PENNSYLVANIA

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

RHODE ISLAND

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

SOUTH CAROLINA

Served by the Raleigh, North Carolina Field Office
Phone: (919) 233-7999
Fax: (919) 233-3433

SOUTH DAKOTA

Served by the St. Paul, Minnesota Field Office
Phone: (612) 481-3297
Fax: (612) 481-1735

TENNESSEE

Served by the Huntsville, Alabama Field Office
Phone: (205) 830-9212
Fax: (205) 837-2666

TEXAS

Dallas
2435 Kinwest Parkway
Suite 101
Irving 75063
Phone: (972) 401-1666
Fax: (972) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525
Service Fax:
(972) 401-0227

El Paso
1855 Trawood
Suite 101
El Paso 79935
Phone: (915) 593-8090
Fax: (915) 593-8096

Houston
One West Chase Center
10777 Westheimer
Suite 170
Houston 77042
Phone: (713) 784-1800
Fax: (713) 784-4440

UTAH

Served by the Seattle, Washington Field Office
Phone: (206) 644-1001
Fax: (206) 644-1055
For Orders:
(800) 835-3553

VERMONT

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

VIRGINIA

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

WASHINGTON

Seattle
3245 146th Place SE,
Suite 120
Bellevue 98007
Phone: (206) 644-1001
Fax: (206) 644-1055
For Orders:
(800) 835-3553

WEST VIRGINIA

Served by the DC, Maryland Field Office
Phone: (301) 948-7151
Fax: (301) 921-9273
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

WISCONSIN

Served by the Portland, Oregon Field Office
Phone: (503) 627-7999
Fax: (503) 627-7995
Toll Free: (800) 621-1966
Toll Free Service:
(800) TEK-WIDE Ext. 6630
Service Phone:
(503) 627-6630
Service Fax:
(503) 627-6576

WYOMING

Served by the Portland, Oregon Field Office
Phone: (503) 627-7999
Fax: (503) 627-7995
Toll Free: (800) 621-1966
For Orders:
(800) 835-3553

PUERTO RICO

San Juan
Served by
TeleNetworks, Inc.
P.O. Box 363847
San Juan 00936
Phone: 809-766-2829

US VIRGIN ISLANDS

San Juan
Served by
TeleNetworks, Inc.
P.O. Box 363847
San Juan 00936
Puerto Rico
Phone: 809-766-2829

US GOVERNMENT AGENCIES

Tektronix Federal Order Management Office.
P.O. Box 4600, M/S 50-290
Beaverton, OR 97076
Phone: 1-800-682-1210
Fax: (503) 629 5388

Requests for product information and technical support should be directed to the Tektronix Sales and Service Office nearest you.

Requests for quotations solicitations, purchase orders, contracts, BPA calls, and Government Commercial Credit Card transactions go to the Tektronix Federal Order Management Office.

URUGUAY

Coasin Instrumentos S.A.
Acevedo Diaz 1161
Montevideo
C.P.
11200
Uruguay
Phone: 598 (2) 49-2436
Fax: 598 (2) 49-2199

VENEZUELA

Omnivideo del Color, C.A.
Av. Romulo Gallegos
Edificio Johnson &
Johnson, Oficina 2-D
Los Dos Caminos
Caracas
Venezuela
Phone: 58 (2) 237-7762
Fax: 58 (2) 237-8275

YEMEN ARAB REPUBLIC

TekSignals
8th Floor, Suite no. 81
GIBCA Building
P.O. Box 47520
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971 (2) 343401
Fax: 971 (2) 327069
Telex:
24325 MDSUAE EM

YUGOSLAVIA

Bel Systems d.o.o. Beograd
Dusana Brankovica 5
Beograd
YU-11030
Yugoslavia
Phone: (381) 11-546081
Fax: (381) 11-553751

CORPORATE OFFICE

Wilsonville
26600 SW Parkway
P.O. Box 1000
Wilsonville, OR
97070-1000
Phone: (503) 682-3411
Phone: (800) TEK-WIDE

Distributors

The following list identifies distributors to contact for your area. In cases where their are no designated distributors located within a given state, the distributor to contact outside the state is provided.

ALASKA

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

NW Test and Measurement
Beaverton, OR
(503) 645-9000
(800) 320-9001

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

ALABAMA

Birmingham
Anixter
(205) 822-8066

Newark Electronics, Inc.
(205) 979-7003
(800) 463-9275

Huntsville
Allied Electronics
(205) 721-3500
(800) 433-5700

FAI
(205) 971-1324
(800) 746-4324

Future
(205) 971-1324
(800) 866-9209

R&R Instrumentation, Inc
(205) 883-6699
(800) 523-8784

Marshall Industries, Inc.
(205) 881-9235
(800) 432-2223

Newark Electronics, Inc.
(205) 837-9091
(800) 463-9275

RS Electronics
(205) 721-9999
(800) 859-5859

Mobile
Allied Electronics
(334) 476-1875
(800) 433-5700

Additional distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Dow Electronics
Tampa, FL
(813) 626-5195
(800) 617-2990

Inotek
Dallas, TX
(972) 243-7000
(800) 492-6767

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

ARKANSAS

Fayetteville
RS Electronics
(501) 582-0608

Little Rock
Newark Electronics, Inc.
(501) 225-8130
(800) 463-9275

Additional distributors for this state:

Anixter
Skokie, IL
(847) 677-2600

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

EnTest
Carrollton, TX
(972) 980-9875
(800) 955-0077

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

ARIZONA

Phoenix
FAI
(602) 731-4661
(800) 746-4324

Jensen Tools, Inc.
(602) 968-6241

Marshall Industries, Inc.
(602) 496-0290
(800) 432-2223

Zeus Electronics, Inc.
(602) 263-6022
(800) 528-4512

Tempe
Allied Electronics
(602) 831-2002
(800) 433-5700

Anixter
(602) 968-7901

Metermaster
(602) 431-0015
(800) 241-4443

Newark Electronics, Inc.
(602) 966-6340
(800) 463-9275

Techni-Tool, Inc.
(602) 590-1544
(800) 382-8665

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Instrument Engineers
San Diego, CA
(619) 673-3644
(800) 444-6106

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

CALIFORNIA

Agoura Hills
FAI
(818) 879-1234
(800) 746-4324

Future
(818) 879-1234
(800) 274-0818

Anaheim
Anixter
(714) 779-0500

Specialized Products
(714) 974-9740
(800) 866-5353

Chatsworth
ITC Electronics
(818) 700-0900
(800) 225-5482

Chula Vista
Newark Electronics, Inc.
(619) 691-0141
(800) 463-9275

Cupertino
Jensen Tools, Inc.
(800) 426-1194

Duarte
Zack Electronics
(818) 303-1183
(800) 998-3947

El Monte
Marshall Industries, Inc.
(818) 307-6000
(800) 432-2223

Fountain Valley
Techni-Tool, Inc.
(714) 829-2320
(800) 382-8665

Glendale
Anixter
(818) 637-2470

Huntington Beach
Techni-Tool, Inc.
(714) 846-3452
(800) 382-8665

Inglewood
Newark Electronics, Inc.
(800) 463-9275

Irvine
Allied Electronics
(714) 727-3010
(800) 433-5700

FAI
(714) 753-4778
(800) 746-4324

Marshall Industries, Inc.
(714) 458-5301
(800) 432-2223

Los Angeles
ITC Electronics
(213) 388-7502
(800) 225-5482

Milpitas
Marshall Industries, Inc.
(408) 942-4712
(800) 432-2223

Oakland
Brill Electronics
(510) 834-5888
(800) 845-3427

Oxnard
ITC Electronics
(805) 983-4115
(800) 225-5482

Palo Alto
Newark Electronics, Inc.
(415) 812-6300
(800) 463-9275

Pleasanton
Anixter
(510) 463-1223

Rancho Cordova
Marshall Industries, Inc.
(916) 635-9700
(800) 432-2223

Distributors

Rancho Cucamonga
Allied Electronics
(909) 980-6522
(800) 433-5700

Newark Electronics, Inc.
(909) 980-2105
(800) 463-9275

Rocklin
Allied Electronics
(916) 632-3104
(800) 433-5700

Roseville
FAI
(916) 782-7882
(800) 746-4324

Future
(916) 782-7882
(800) 630-6530

Sacramento
Anixter
(916) 372-1207

Newark Electronics, Inc.
(916) 565-1760
(800) 463-9275

Zack Electronics
(916) 369-1786
(800) 998-3947

San Diego
Allied Electronics
(619) 279-2550
(800) 433-5700

Anixter
(619) 583-9960

FAI
(619) 623-2888
(800) 746-4324

Future
(619) 623-2888
(800) 757-9438

Instrument Engineers
(619) 673-3644
(800) 444-6106

Newark Electronics, Inc.
(619) 453-8211
(800) 463-9275

San Francisco
Techni-Tool, Inc.
(415) 922-3711
(800) 382-8665

San Jose
Allied Electronics
(408) 383-0366
(800) 433-5700

Anixter
(408) 435-1212

FAI
(415) 543-2833
(800) 746-4324

Future
(415) 543-2833
(800) 851-7178

Zack Electronics
(408) 324-0551
(800) 998-3947

Santa Ana
Techni-Tool, Inc.
(714) 731-7733
(800) 382-8665

Santa Clara
Techni-Tool, Inc.
(408) 261-9230
(800) 382-8665

Santa Fe Springs
Newark Electronics, Inc.
(310) 929-9722
(800) 463-9275

Sunnyvale
Specialized Products
(408) 730-6820
(800) 866-5353

Thousand Oaks
Marshall Industries, Inc.
(818) 878-7047
(800) 432-2223

Newark Electronics, Inc.
(805) 499-1480
(800) 463-9275

TestEquity, Inc.
(805) 498-9933
(800) 732-3457

Torrance
Anixter
(310) 320-4783

Tustin
Techni-Tool, Inc.
(714) 731-4365
(800) 382-8665

Union City
Anixter
(510) 489-7100

Woodland Hills
Allied Electronics
(818) 598-0130
(800) 433-5700

Yorba Linda
Metermaster
(714) 921-2101
(800) 241-4443

Additonal distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

COLORADO

Aurora
Anixter
(303) 373-9200

R&R Instrumentation, Inc.
(303) 364-8325
(800) 452-1463

Commerce City
Techni-Tool, Inc.
(303) 288-7210
(800) 382-8665

Denver
Newark Electronics, Inc.
(303) 373-4540
(800) 463-9275

Specialized Products
(303) 694-5369
(800) 866-5353

Englewood
Allied Electronics
(303) 790-1664
(800) 433-5700

Lakewood
FAI
(303) 237-1400
(800) 746-4324

Future
(303) 237-1400
(800) 303-5701

Parker
Jensen Tools, Inc.
(303) 805-0377
(800) 426-1194

Thornton
Marshall Industries, Inc.
(303) 451-8444
(800) 432-2223

Wheatridge
Zeus Electronics, Inc.
(303) 420-5100
(800) 998-3947

Additonal distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

CONNECTICUT

Bloomfield
Newark Electronics, Inc.
(860) 243-1731
(800) 463-9275

Cheshire
Allied Electronics
(203) 272-7730
(800) 433-5700

Anixter
(203) 271-3600

FAI
(203) 250-1319
(800) 746-4324

Future
(203) 250-1319
(800) 688-1319

Higganum
Metermaster
(860) 345-2920
(800) 241-4443

Stamford
Anixter
(203) 325-0390

Specialized Products
(203) 321-1250
(800) 866-5353

Wallingford
Contact East
(203) 265-9333
(800) 225-5370

Marshall Industries, Inc.
(203) 265-3822
(800) 432-2223

West Hartford
Techni-Tool, Inc.
(203) 657-8665
(800) 382-8665

Additonal distributors for this state:

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

DISTRICT OF COLUMBIA

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire QC, Canada
(514) 694-7710
(800) 388-8731

Harco Electronics, Inc.
Aberdeen, MD
(410) 838-7990
(800) 638-7616

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

DELAWARE

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire QC, Canada
(514) 694-7710
(800) 746-432

Future
Pointe Claire QC, Canada
(514) 694-7710
(800) 388-8731

Harco Electronics, Inc.
Aberdeen, MD
(410) 838-7990
(800) 638-7616

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

Distributors

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Sunshine Instruments
Philadelphia, PA
(215) 673-5600
(800) 343-1199

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

FLORIDA

Altamonte Springs
Marshall Industries, Inc.
(407) 767-8585
(800) 432-2223

FAI
(407) 865-9555
(800) 746-4324

Boca Raton
Anixter
(407) 997-0838

Deerfield Beach
FAI
(954) 428-9494
(800) 746-4324

Ft Lauderdale
Marshall Industries, Inc.
(305) 977-4880
(800) 432-2223

Newark Electronics, Inc.
(954) 486-1151
(800) 463-9275

Ft. Pierce
Techni-Tool, Inc.
(407) 464-0461
(800) 382-8665

Jacksonville
Allied Electronics
(904) 739-5920
(800) 433-5700

Anixter
(904) 730-2703

Dow Electronics
(904) 367-0377
(800) 627-2960

EMSCO
(904) 281-2220
(800) 275-3029

Jensen Tools, Inc.
(904) 268-9555
(800) 426-1194

Newark Electronics, Inc.
(904) 399-5041
(800) 463-9275

Largo
FAI
(813) 530-1665
(800) 746-4324

Future
(813) 530-1665
(800) 365-1665

Specialized Products
(800) 794-1500
(800) 866-5353

Maitland
Allied Electronics
(407) 539-0055
(800) 433-5700

Miami
Electronic Equipment Co., Inc.
(305) 871-1500
(800) 327-1526

Miami Lakes
Allied Electronics
(305) 558-2511
(800) 433-5700

Melbourne
RS Electronics
(407) 253-4241
(800) 621-6628

Orlando
Anixter
(407) 240-1888

Dow Electronics
(407) 426-6822
(800) 627-2970

EMSCO
(407) 849-6060
(800) 275-3554

Newark Electronics, Inc.
(407) 896-8350
(800) 463-9275

Pampano Beach
Electronic Equipment Co., Inc.
(305) 960-1200
(800) 327-1526

Pembroke Pines
Electronic Equipment Co., Inc.
(305) 431-1488
(800) 327-1526

St. Cloud
Contact East
(888) 925-2960

St. Petersburg
Allied Electronics
(813) 579-4660
(800) 433-5700

Marshall Industries, Inc.
(813) 573-1399
(800) 432-2223

Tallahassee
FAI
(904) 668-7772
(800) 746-4324

Tampa
Anixter
(813) 626-7115

Dow Electronics
(813) 626-5195
(800) 617-2990

EMSCO
(813) 248-5499
(800) 275-3031

Newark Electronics, Inc.
(813) 287-1578
(800) 463-9275

Additional distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

GEORGIA

Albany
Dow Electronics
(912) 435-1711
(800) 627-2830

Atlanta
Specialized Products
(770) 956-4042
(800) 866-5353

Duluth
Allied Electronics
(770) 497-9544
(800) 433-5700

Fayetteville
Electronic Equipment Co., Inc.
(770) 719-2050

Forest Park
Avnet Industrial
(404) 362-5900
(800) 332-3423

Marietta
Metermaster
(770) 919-0264
(800) 241-4443

Norcross
Anixter
(770) 921-3732

Dow Electronics
(813) 662-5195
(800) 627-2920

EMSCO
(770) 925-8366
(800) 275-3033

FAI
(770) 447-4767
(800) 746-4324

Future
(770) 447-4767
(800) 766-4767

Marshall Industries, Inc.
(770) 923-5750
(800) 432-2223

Newark Electronics, Inc.
(770) 448-1300
(800) 463-9275

RS Electronics
(770) 242-0520
(800) 776-5284

Savannah
Dow Electronics
(912) 234-1684
(800) 627-2890

Stone Mountain
Resource Electronics/Dixie
(770) 381-7478
(800) 854-1009

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

Additional distributors for this state:

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Inotek
Dallas, TX
(972) 243-7000
(800) 492-6767

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

HAWAII

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

NW Test and Measurement
Beaverton, OR
(503) 645-9000
(800) 320-9001

Radar, Inc.
Seattle, WA
(206) 282-2511
(800) 282-2524

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

IOWA

Bettendorf
Newark Electronics, Inc.
(319) 359-3711
(800) 463-9275

Cedar Rapids
Allied Electronics
(319) 390-5730
(800) 433-5700

Newark Electronics, Inc.
(319) 393-3800
(800) 463-9275

Distributors

Des Moines
Anixter
(515) 278-1722

West Des Moines
Newark Electronics, Inc.
(515) 222-0700
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Klaus Companies
Peoria, IL
(309) 691-4840
(800) 545-5287

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Stark Electronics, Inc.
Minneapolis, MN
(612) 332-1325
(800) 334-6154

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester,NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland,TX
(214) 348-8800
(800) 527-4642

IDAHO

Boise
Allied Electronics
(208) 331-1414
(800) 433-5700

Anixter
(208) 377-3104

FAI
(208) 376-8080
(800) 746-4324

Newark Electronics, Inc.
(208) 342-4311
(800) 463-9275

Radar, Inc.
(208) 336-2227

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore,MD
(410) 358-3900
(800) 368-2516

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

NW Test and Measurement
Beaverton, OR
(503) 645-9000
(800) 320-9001

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

Westcon, Inc.
Portland, OR
(503) 598-8700
(800) 547-4515

Zeus Electronics, Inc.
Phoenix, AZ
(602) 263-6022
(800) 528-4512

ILLINOIS

Addison
Metermaster
(630) 268-8100
(800) 241-4443

Bannockburn
Specialized Products
(708) 821-2790
(800) 866-5353

Bensenville
Allied Electronics
(630) 860-0007
(800) 433-5700

Inotek
(630) 350-2500
(800) 492-6767

Champaign
Klaus Companies
(217) 356-1896
(800) 221-5951

Chicago
Newark Electronics, Inc.
(773) 784-5100
(800) 463-9275

Des Plaines
Transcat
(847) 299-2781
(800) 828-1470

Grayslake
Allied Electronics
(847) 548-9330
(800) 433-5700

Hoffman Estates
FAI
(847) 843-0034
(800) 746-4324

Future
(847) 843-0034
(800) 283-1899

Loves Park
Allied Electronics
(815) 636-1010
(800) 433-5700

Mt. Prospect
Anixter
(847) 298-6040

Niles
Joseph Electronics
(847) 297-4200
(800) 323-5925

Oak Forest
Allied Electronics
(708) 535-0038
(800) 433-5700

Peoria
Klaus Companies
(309) 691-4840
(800) 545-5287

Quincy
Klaus Companies
(217) 223-7560

Rockford
Newark Electronics, Inc.
(815) 229-0225
(800) 463-9275

Schaumburg
Marshall Industries, Inc.
(847) 490-0755
(800) 432-2223

Newark Electronics, Inc.
(847) 310-8980
(800) 463-9275

Skokie
Anixter
(847) 677-2600

Springfield
Newark Electronics, Inc.
(217) 787-9972
(800) 463-9275

Willowbrook
Newark Electronics, Inc.
(630) 789-4780
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

RS Electronics
Livonia, MI
(313) 525-1155
(313) 525-1184

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

INDIANA

Carmel
Allied Electronics
(317) 571-1880
(800) 433-5700

Ft. Wayne
Newark Electronics, Inc.
(219) 484-0766
(800) 463-9275

Indianapolis
Anixter
(317) 243-2008

FAI
(317) 469-0441
(800) 746-4324

Future
(317) 469-0441
(800) 915-0441

Great Lakes Electronics
(317) 841-1024
(800) 968-2009

Marshall Industries, Inc.
(317) 388-9069
(800) 432-2223

Newark Electronics, Inc.
(317) 844-0047
(800) 463-9275

RS Electronics
(317) 253-9065
(800) 488-9065

Stark Electronics
(317) 894-3732
(800) 682-3732

Portage
Transcat
(219) 763-9740
(800) 828-1470

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Joseph Electronics
Niles, IL
(847) 297-4200
(800) 323-5925

Klaus Companies
Peoria, IL
(309) 691-4840
(800) 545-5287

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

KANSAS

Lenexa
Anixter
(913) 492-2622

Marshall Industries, Inc.
(913) 492-3121
(800) 432-2223

Overland Park
Allied Electronics
(913) 338-4372
(800) 433-5700

FAI
(913) 338-4400
(800) 746-4324

Future
(913) 338-4400
(800) 757-6802

Newark Electronics, Inc.
(913) 677-0727
(800) 463-9275

RS Electronics
(913) 362-1923
(800) 859-3443

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Electronics Supply Co., Inc.
Kansas City, MO
(816) 931-0250
(800) 669-3752

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Distributors

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

KENTUCKY

Louisville
Allied Electronics
(502) 452-2293
(800) 433-5700

Anixter
(502) 266-8555

Newark Electronics, Inc.
(502) 423-0280
(800) 463-9275

Additional distributors for this state:

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Stark Electronics
Indianapolis, IN
(317) 894-3732
(800) 682-3732

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

LOUISIANA

Baton Rouge
Anixter
(504) 767-0080
(800) 962-1002

Transcat
(504) 272-9156
(800) 828-1470

Covington
EnTest
(504) 892-0988
(800) 955-0077

Metairie
Anixter
(504) 828-1952

Newark Electronics, Inc.
(504) 838-9771
(800) 463-9275

St. Rose
Allied Electronics
(504) 466-7575
(800) 433-5700

Additional distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MASSACHUSETTS

Bolton
FAI
(508) 779-3111
(800) 746-4324

Future
(508) 779-3111
(800) 933-5918

Danvers
Beta Lambda Instruments
(508) 762-7303
(800) 282-5632

Mansfield
Anixter
(508) 261-1313

Marlborough
Newark Electronics, Inc.
(508) 229-2200
(800) 463-9275

Methuen
Anixter
(508) 682-8870

North Andover
Contact East
(508) 682-2000
(888) 925-2960

Northboro
Techni-Tool, Inc.
(508) 393-3399
(800) 382-8665

Norwood
Allied Electronics
(617) 255-0361
(800) 433-5700

Peabody
Allied Electronics
(508) 538-2401
(800) 433-5700

Sandwich
Techni-Tool, Inc.
(508) 888-5133
(800) 382-8665

Wilmington
Marshall Industries, Inc.
(508) 658-0810
(800) 432-2223

Woburn
Newark Electronics, Inc.
(617) 935-8350
(800) 463-9275

Additional distributors for this state:

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MARYLAND

Aberdeen
Harco Electronics, Inc.
(410) 838-7990
(800) 638-7616

Baltimore
Davis Instruments
(410) 358-3900
(800) 368-2516

Harco Electronics, Inc.
(410) 636-4444
(800) 404-2726

Techni-Tool, Inc.
(410) 233-7142
(800) 382-8665

Columbia
Allied Electronics
(410) 312-0810
(800) 433-5700

Anixter
(410) 290-7722

FAI
(410) 312-0833
(800) 746-4324

Future
(410) 312-0833
(800) 934-5206

Marshall Industries, Inc.
(410) 880-3030
(800) 432-2223

Gambrills
Techni-Tool, Inc.
(301) 912-3062
(800) 382-8665

Hanover
Newark Electronics, Inc.
(410) 712-6922
(800) 463-9275

Hunt Valley
TESSCO
(410) 229-1393
(800) 472-7373

Olney
Beta Lambda Instruments
(301) 570-1964
(800) 282-5632

Salisbury
Harco Electronics, Inc.
(410) 548-1800
(800) 634-2589

Sparks
TESSCO
(410) 472-7000
(800) 472-7373

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Sunshine Instruments
Philadelphia, PA
(215) 673-5600
(800) 343-1199

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MAINE

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Distributors

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MICHIGAN

Battle Creek
Great Lakes Electronics
(616) 963-6282
(800) 962-3144

Farmington Hills
Anixter
(810) 478-3900

Flint
RS Electronics
(810) 742-5000
(800) 726-4556

Grand Rapids
Future
(616) 698-6800

Grand Rapids
Allied Electronics
(616) 365-9960
(800) 433-5700

Anixter
(616) 698-7800

Newark Electronics, Inc.
(616) 954-6700
(800) 463-9275

RS Electronics
(616) 241-3483
(800) 776-1155

Livonia
FAI
(313) 513-0015
(800) 746-4324

Future
(313) 513-0015
(800) 395-5584

Marshall Industries, Inc.
(313) 525-5850
(800) 432-2223

RS Electronics
(313) 525-1155
(313) 525-1184

Plymouth
Allied Electronics
(313) 416-9300
(800) 433-5700

Saginaw
Newark Electronics, Inc.
(517) 799-0480
(800) 463-9275

Troy
Metermaster
(810) 689-0176
(800) 241-4443

Newark Electronics, Inc.
(810) 583-2899
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MINNESOTA

Eden Prairie
Dist-Tron
(612) 916-1800

FAI
(612) 947-0909
(800) 746-4324

Future
(612) 947-0909
(800) 894-7631

Minneapolis
Newark Electronics, Inc.
(612) 331-6350
(800) 463-9275

Stark Electronics, Inc.
(612) 332-1325
(800) 334-6154

Minnetonka
Allied Electronics
(612) 938-5633
(800) 433-5700

Plymouth
Anixter
(612) 559-2690

Marshall Industries, Inc.
(612) 837-1991
(800) 432-2223

St. Paul
Newark Electronics, Inc.
(612) 631-2683
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MISSOURI

Earth City
Allied Electronics
(314) 291-7031
(800) 433-5700

Kansas City
Electronics Supply Co., Inc.
(816) 931-0250
(800) 669-3752

Maryland Heights
RS Electronics
(314) 997-7709
(800) 325-4806

Overland
Anixter
(314) 423-6161

St. Louis
FAI
(314) 542-9922
(800) 746-4324

Future
(314) 542-9922
(800) 757-9923

Newark Electronics, Inc.
(314) 453-9400
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MISSISSIPPI

Ridgeland
Newark Electronics, Inc.
(601) 956-3834
(800) 463-9275

Additional distributors for this state:

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

EnTest
Carrollton, TX
(972) 980-9875
(800) 955-0077

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

MONTANA

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

NW Test and Measurement
Beaverton, OR
(503) 645-9000
(800) 320-9001

Radar, Inc.
Seattle, WA
(206) 282-2511
(800) 282-2524

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

Distributors

Zeus Electronics, Inc.
Phoenix, AZ
(602) 263-6022
(800) 528-4512

NORTH CAROLINA

Cary
Inotek
(919) 380-0220
(800) 492-6767

Charlotte
Allied Electronics
(704) 525-0300
(800) 433-5700

Anixter
(704) 847-5900

Avnet Industrial
(704) 561-9400
(800) 332-3423

FAI
(704) 548-9503
(800) 746-4324

Future
(704) 548-9503
(800) 767-9075

Inotek
(704) 527-5000
(800) 492-6767

Newark Electronics, Inc.
(704) 535-5650
(800) 463-9275

Resource Electronics/Dixie
(704) 521-8682
(800) 854-1003

Transcat
(704) 536-7795
(800) 828-1470

Cherryville
Beta Lambda Instruments
(800) 282-5632

Durham
Anixter
(919) 941-5023

Greensboro
EMSCO
(910) 275-8776
(800) 275-3034

Newark Electronics, Inc.
(910) 294-2142
(800) 463-9275

Raleigh
Allied Electronics
(919) 876-5845
(800) 433-5700

FAI
(919) 876-0088
(800) 746-4324

Future
(919) 876-0088
(800) 937-0088

Marshall Industries, Inc.
(919) 878-9882
(800) 432-2223

Resource Electronics/Dixie
(919) 829-0704
(800) 854-1016

Winston Salem
Resource Electronics/Dixie
(910) 724-5961
(800) 854-1007

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

NORTH DAKOTA

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Stark Electronics, Inc.
Minneapolis, MN
(612) 332-1325
(800) 334-6154

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

NEBRASKA

Lincoln
Anixter
(402) 466-8337

Omaha
Anixter
(402) 330-7455

Allied Electronics
(402) 697-0038
(800) 433-5700

Electronics Supply Co., Inc.
(402) 896-2238
(800) 669-3752

Newark Electronics, Inc.
(402) 592-2423
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

NEW HAMPSHIRE

Bedford
Anixter
(508) 794-2075

Nashua
Newark Electronics, Inc.
(603) 888-5790
(800) 463-9275

Additional distributors for this state:

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester,.NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

NEW JERSEY

Butler
Techni-Tool, Inc.
(201) 492-1292
(800) 382-8665

Cranbury
Anixter
(609) 860-1382

East Brunswick
Allied Electronics
(908) 613-0828
(800) 433-5700

Newark Electronics, Inc.
(908) 937-6600
(800) 463-9275

East Rutherford
Metermaster
(800) 241-4443

Edison
Avnet Industrial
(908) 248-3200
(800) 332-3423

Englishtown
Beta Lambda Instruments
(800) 282-5632
(800) 282-5632

Fairfield
Marshall Industries, Inc.
(201) 882-0320
(800) 432-2223

Florham Park
Anixter
(201) 660-0278

Marlton
FAI
(609) 988-1500
(800) 746-4324

Future
(609) 988-1500
(800) 228-4832

Mt. Laurel
Allied Electronics
(609) 234-7769
(800) 433-5700

Marshall Industries, Inc.
(609) 234-9100
(800) 432-2223

Paramus
Transcat
(201) 986-1661
(800) 828-1470

Parsippany
Allied Electronics
(201) 428-3350
(800) 433-5700

FAI
(201) 331-1133
(800) 746-4324

Future
(201) 331-1133
(800) 527-0426

Additional distributor for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Distributors

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Sunshine Instruments
Philadelphia, PA
(215) 673-5600
(800) 343-1199

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

NEW MEXICO

Albuquerque
Allied Electronics
(505) 266-7565
(800) 433-5700

Anixter
(505) 345-1661

Newark Electronics, Inc.
(505) 828-1878
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

Zeus Electronics, Inc.
Phoenix, AZ
(602) 263-6022
(800) 528-4512

NEVADA

Las Vegas
Allied Electronics
(702) 258-1087
(800) 433-5700

Additional distributors for this state:

Anixter
Skokie, IL
(847) 677-2600

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

Zack Electronics
San Jose, CA
(408) 324-0551
(800) 998-3947

Zeus Electronics, Inc.
Phoenix, AZ
(602) 263-6022
(800) 528-4512

NEW YORK

Albany
Anixter
(518) 464-6251

Amherst
Allied Electronics
(716) 831-8101
(800) 433-5700

Apalachin
Beta Lambda Instruments
(607) 625-3526
(800) 282-5632

Bohemia
Exphil Calibration Labs, Inc.
(516) 563-3520
(800) 539-7445

Newark Electronics, Inc.
(516) 567-4200
(800) 463-9275

Endicott
Marshall Industries, Inc.
(607) 785-2345
(800) 432-2223

Great Neck
Allied Electronics
(516) 487-5211
(800) 433-5700

Hauppage
Allied Electronics
(516) 234-0485
(800) 433-5700

FAI
(516) 348-3700
(800) 746-4324

Future
(516) 348-3700
(800) 964-6117

RS Electronics
(516) 231-3313
(800) 433-8952

Lagrangeville
Allied Electronics
(914) 452-1470
(800) 433-5700

Latham
Newark Electronics, Inc.
(518) 783-0983
(800) 463-9275

Liverpool
Newark Electronics, Inc.
(315) 457-4873
(800) 463-9275

Pittsford
Newark Electronics, Inc.
(716) 381-4244
(800) 463-9275

Rochester
Allied Electronics
(716) 292-1670
(800) 433-5700

Anixter
(716) 426-3440

Beta Lambda Instruments
(716) 473-7553
(800) 282-5632

Contact East
(800) 959-5570

FAI
(716) 387-9600
(800) 746-4324

Future
(716) 387-9600
(800) 915-9601

Marshall Industries, Inc.
(716) 235-7620
(800) 432-2223

Transcat
(716) 352-9720
(800) 828-1470

Transcat
(716) 723-3661
(800) 828-1470

Transcat
(716) 865-8693
(800) 828-1470

Ronkonkoma
Marshall Industries, Inc.
(516) 737-9300
(800) 432-2223

Syracuse
Allied Electronics
(315) 446-7411
(800) 433-5700

FAI
(315) 451-4405
(800) 746-4324

Future
(315) 451-4405
(800) 627-4405

Wappingers Falls
Newark Electronics, Inc.
(914) 298-2810
(800) 463-9275

Williamsville,
Newark Electronics, Inc.
(716) 631-2311
(800) 463-9275

Additional distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

OHIO

Beechwood
Allied Electronics
(216) 831-4900
(800) 433-5700

Beavercreek
FAI
(937) 427-6090
(800) 746-4324

Future
(937) 427-6090
(800) 430-6090

Brecksville
Anixter
(216) 546-4400

Centerville
MCM Electronics
(937) 434-0031
(800) 543-4330

Cincinnati
Allied Electronics
(513) 771-6990
(800) 433-5700

Anixter
(513) 489-2290

Newark Electronics, Inc.
(513) 772-8181
(800) 463-9275

Cleveland
Metermaster
(216) 351-1234
(800) 241-4443

Newark Electronics, Inc.
(216) 391-9330
(800) 463-9275

RS Electronics
(216) 351-2220
(800) 576-4533

Columbus
Newark Electronics, Inc.
(614) 326-0352
(800) 463-9275

Dayton
Beta Lambda Instruments
(513) 235-2120
(800) 282-5623

Marshall Industries, Inc.
(513) 898-4480
(800) 432-2223

Newark Electronics, Inc.
(937) 294-8980
(800) 463-9275

Dublin
Anixter
(614) 799-2600

Fairborn
Anixter
(513) 320-0010

Mayfield Heights
FAI
(216) 446-0061
(800) 746-4324

Future
(216) 446-0061
(800) 843-6427

Solon
Marshall Industries, Inc.
(216) 248-1788
(800) 432-2223

Toledo
Newark Electronics, Inc.
(419) 866-0404
(800) 463-9275

Distributors

Worthington
Allied Electronics
(614) 785-1270
(800) 433-5700

Youngstown
Newark Electronics, Inc.
(330) 793-6134
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Stark Electronics
Indianapolis, IN
(317) 894-3732
(800) 682-3732

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

OKLAHOMA

Broken Arrow
EnTest
(918) 357-3727
(800) 955-0077

Oklahoma City
Newark Electronics, Inc.
(405) 843-3301
(800) 463-9275

Piedmont
Inotek
(405) 373-3359
(800) 492-6767

Tulsa
Allied Electronics
(918) 250-4505
(800) 433-5700

Anixter
(918) 664-5558
(800) 722-3520

FAI
(918) 492-1500
(800) 746-4324

Inotek
(918) 627-1500
(800) 492-6767

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

OREGON

Beaverton
Allied Electronics
(503) 626-9921
(800) 433-5700

Anixter
(503) 306-4100

FAI
(800) 746-4324

Future
15236 NW Greenbrier Pkwy.

Marshall Industries, Inc.
(503) 644-5050
(800) 432-2223

NW Test and Measurement
(503) 645-9000
(800) 320-9001

Portland
Newark Electronics, Inc.
(503) 297-1984
(800) 463-9275

Radar, Inc.
(503) 232-3404
(800) 822-8336

Westcon, Inc.
(503) 598-8700
(800) 547-4515

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241
(800) 388-8731

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

PENNSYLVANIA

Allentown
Newark Electronics, Inc.
(610) 434-7171
(800) 463-9275

Braddock
Leff Electronics
(412) 351-5000
(800) 245-4200

Chadds Ford
Allied Electronics
(610) 388-8455
(800) 433-5700

Fort Washington
Newark Electronics, Inc.
(215) 654-1434
(800) 463-9275

Harrisburg
Allied Electronics
(717) 540-7101
(800) 433-5700

Anixter
(717) 232-6219

Lancaster
Harco Electronics, Inc.
(717) 291-1861
(800) 345-4941

Norristown
Jensen Tools, Inc.
(610) 272-2280
(800) 426-1194

Philadelphia
Sunshine Instruments
(215) 673-5600
(800) 343-1199

Pittsburgh
Allied Electronics
(412) 931-2774
(800) 433-5700

Anixter
(412) 494-4300

Newark Electronics, Inc.
(412) 788-4790
(800) 463-9275

Transcat
(412) 635-9146
(800) 828-1470

Plymouth Meeting
Techni-Tool, Inc.
(610) 825-4990
(800) 382-8665

Sharon Hill
Anixter
(610) 534-3900

West Chester
Transcat
(610) 692-0912
(800) 828-1470

Additional distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

PUERTO RICO

San Juan
TeleNetworks, Inc.
(797) 766-2829

RHODE ISLAND

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

Distributors

SOUTH CAROLINA

Columbia
Resource Electronics/Dixie
(803) 779-5332
(800) 854-1002

Goose Creek
Resource Electronics/Dixie
(803) 569-1410
(800) 854-1006

Greenville
Allied Electronics
(864) 288-8835
(800) 433-5700

Newark Electronics, Inc.
(803) 288-9610
(800) 463-9275

Resource Electronics/Dixie
(803) 297-1430
(800) 854-1004

RS Electronics
(864) 675-0505
(800) 258-3603

Greer
EMSCO
(864) 879-4121
(800) 275-2934

North Charleston
Anixter
(803) 572-5526

Rockhill
Transcat
(803) 327-0265
(800) 828-1470

Additonal distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire QC, Canada
(514) 694-7710
(800) 388-8731

Inotek
Dallas, TX
(972) 243-7000
(800) 492-6767

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

SOUTH DAKOTA

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Stark Electronics, Inc.
Minneapolis, MN
(612) 332-1325
(800) 334-6154

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

TENNESSEE

Brentwood
Newark Electronics, Inc.
(615) 371-1341
(800) 463-9275

RS Electronics
(615) 370-6440
(800) 421-6440

Gray
Resource Electronics/Dixie
(615) 477-2131
(800) 482-5439

Knoxville
Avnet Industrial
(423) 966-3441
(800) 332-3423

Newark Electronics, Inc.
(423) 588-6493
(800) 463-9275

Memphis
Anixter
(901) 360-8222

Avnet Industrial
(901) 369-8800
(800) 332-3423

Newark Electronics, Inc.
(901) 396-7970
(800) 463-9275

Nashville
Anixter
(615) 781-2560

R&R Instrumentation, Inc
(615) 256-8911
(888) 767-4678

Oak Ridge
Resource Electronics/Dixie
(615) 481-3393
(800) 854-1005

Additonal distributors for this state:

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Dow Electronics
Tampa, FL
(813) 626-5195
(800) 617-2990

FAI
Pointe Claire QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire QC, Canada
(514) 694-7710
(800) 388-8731

Inotek
Dallas, TX
(972) 243-7000
(800) 492-6767

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

TEXAS

Austin
Allied Electronics
(512) 219-7171
(800) 433-5700

Anixter
(512) 339-9222
(800) 222-4170

Marshall Industries, Inc.
(512) 837-1991
(800) 432-2223

Newark Electronics, Inc.
(512) 338-0287
(800) 463-9275

Brownsville
Allied Electronics
(210) 548-1129
(800) 433-5700

Carrollton
Anixter
(972) 446-7337
(800) 492-9745

EnTest
(972) 980-9875
(800) 955-0077

Coppell
Jensen Tools, Inc.
(972) 471-0211
(800) 426-1194

Dallas
Allied Electronics
(214) 341-8444
(800) 433-5700

Inotek
(972) 243-7000
(800) 492-6767

Newark Electronics, Inc.
(972) 458-2528
(800) 463-9275

Dripping Springs
Inotek
(512) 894-0699
(800) 492-6767

El Paso
Allied Electronics
(915) 779-6294
(800) 433-5700

FAI
(915) 779-7484
(800) 746-4324

Future
(915) 779-7484
(800) 563-7274

Newark Electronics, Inc.
(915) 772-6367
(800) 463-9275

Techni-Tool, Inc.
(915) 755-9424
(800) 382-8665

Flower Mound
Jensen Tools, Inc.
(800) 426-1194

Friendswood
Transcat
(281) 992-0675
(800) 828-1470

Ft. Worth
Allied Electronics
(817) 595-3500
(800) 433-5700

Garland
Newark Electronics, Inc.
(800) 463-9275

Tucker Electronics
(214) 348-8800
(800) 527-4642

Houston
Anixter
(713) 460-9473
(800) 392-6179

EnTest
(713) 686-7306
(800) 955-0077

FAI
(713) 952-7088
(800) 746-4324

Future
(713) 952-7088
(800) 796-7088

Inotek
(281) 286-5000
(800) 492-6767

Distributors

Marshall Industries, Inc.
(713) 467-1666
(800) 432-2223

Metermaster
(713) 943-1211
(800) 241-4443

Newark Electronics, Inc.
(713) 894-9334
(800) 463-9275

Specialized Products
(713) 917-6790
(800) 866-5353

Transcat
(713) 523-9034
(800) 828-1470

Humble
Allied Electronics
(281) 446-8005
(800) 433-5700

Irving
Specialized Products
(972) 550-1923
(800) 866-5353

Mesquite
Metermaster
(972) 681-2442
(800) 241-4443

Pearland
Transcat
(281) 992-2351
(800) 828-1470

Richardson
FAI
(214) 231-7195
(800) 746-4324

Future
(214) 231-7195
(800) 272-0694

Marshall Industries, Inc.
(972) 705-0614
(800) 432-2223

San Antonio
FAI
(210) 738-3330
(800) 746-4324

Newark Electronics, Inc.
(210) 734-7960
(800) 463-9275

Seabrook
Transcat
(281) 326-5610
(800) 828-1470

Additional distributors for this state:

Avnet Industrial
Chandler, AZ
(602) 940-6500
(800) 332-3423

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Zeus Electronics, Inc.
Phoenix, AZ
(602) 263-6022
(800) 528-4512

UTAH

Salt Lake City
Allied Electronics
(801) 261-5244
(800) 433-5700

Anixter
(801) 973-2121

FAI
(801) 467-9696
(800) 746-4324

Future
(801) 467-9696
(800) 467-9707

Marshall Industries, Inc.
(801) 973-2288
(800) 432-2223

Newark Electronics, Inc.
(801) 261-5660
(800) 463-9275

Additional distributors for this state:

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

NW Test and Measurement
Beaverton, OR
(503) 645-9000
(800) 320-9001

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

Zeus Electronics, Inc.
Phoenix, AZ
(602) 263-6022
(800) 528-4512

VIRGINIA

Charlottesville
Future
(804) 984-5022
(800) 563-7312

Glen Allen
Anixter
(804) 527-0858

Harrisonburg
Harco Electronics, Inc.
(540) 434-8420
(800) 999-8420

Herndon
Newark Electronics, Inc.
(703) 707-9010
(800) 463-9275

Richmond
Newark Electronics, Inc.
(804) 282-5671
(800) 463-9275

Techni-Tool, Inc.
(804) 745-9160
(800) 382-8665

Springfield
Allied Electronics
(703) 644-9515
(800) 433-5700

Virginia Beach
Allied Electronics
(804) 363-8662
(800) 433-5700

Additional distributors in this state:

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Inotek
Dallas, TX
(972) 243-7000
(800) 492-6767

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

VERMONT

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700

Anixter
Skokie, IL
(847) 677-2600

Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632

Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960

Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516

FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324

Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731

Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241

Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223

MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330

Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443

Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275

Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353

Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665

TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373

TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457

Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470

Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

WASHINGTON

Auburn
Techni-Tool, Inc.
(206) 735-5647
(800) 382-8665

Bellevue
NW Test and Measurement
(206) 881-8857
(800) 320-9001

Westcon, Inc.
(206) 747-5055
(800) 547-4515

Bothell
FAI
(206) 485-6616
(800) 746-4324

Future
(206) 485-6616
(800) 926-4371

Marshall Industries, Inc.
(206) 486-5747
(800) 432-2223

Kent
Anixter
(206) 872-6200

Kirkland
Newark Electronics, Inc.
(206) 814-6230
(800) 463-9275

Renton
Allied Electronics
(206) 251-0240
(800) 433-5700

Richland
Radar, Inc.
(509) 943-6790

Seattle
Radar, Inc.
(206) 282-2511
(800) 282-2524

Distributors, Representatives

Spokane
Anixter
(509) 328-5530
Newark Electronics, Inc.
(509) 327-1935
(800) 463-9275
Radar, Inc.
(509) 747-3053
Additional distributors for this state:
Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960
Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516
Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241
MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330
Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353
TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373
TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457
Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470
Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

WISCONSIN

Brookfield
FAI
(414) 792-9778
(800) 746-4324
Future
(414) 792-9778
(800) 850-9778
Brown Deer
Anixter
(414) 355-0222
Hales Corners
Dist-Tron, Inc.
(414) 529-4400
(800) 347-8766
Madison
Newark Electronics, Inc.
(608) 278-0177
(800) 463-9275
Menomonee Falls
Dist-Tron, Inc.
(414) 781-7770
(800) 347-8766
Milwaukee
Newark Electronics, Inc.
(414) 453-9100
(800) 463-9275
New Berlin
Allied Electronics
(414) 796-1280
(800) 433-5700
Waukesha
Marshall Industries, Inc.
(414) 797-8400
(800) 432-2223
Additonal distributors for this state:
Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960
Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516
Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241
Joseph Electronics
Niles, IL
(847) 297-4200
(800) 323-5925
MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330
Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443
Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353
Stark Electronics, Inc.
Minneapolis, MN
(612) 332-1325
(800) 334-6154
Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665
TESSCO
Sparks,MD
(410) 472-7000
(800) 472-7373
TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457
Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470
Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

WEST VIRGINIA

Charleston
Allied Electronics
(800) 433-5700
Poca
Transcat
(304) 776-5387
(800) 828-1470
Additional distributors for this state:
Anixter
Skokie, IL
(847) 677-2600
Beta Lambda Instruments
Englishtown, NJ
(800) 282-5632
(800) 282-5632
Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960
Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516
FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324
Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731
Harco Electronics, Inc.
Aberdeen, MD
(410) 838-7990
(800) 638-7616
Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241
Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223
MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330
Metermaster
Marietta, GA
(770) 919-0264
(800) 241-4443
Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275
Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353
Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665
TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373
TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457
Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642

WYOMING

Allied Electronics
Ft. Worth, TX
(817) 595-3500
(800) 433-5700
Anixter
Skokie, IL
(847) 677-2600
Contact East
North Andover, MA
(508) 682-2000
(888) 925-2960
Davis Instruments
Baltimore, MD
(410) 358-3900
(800) 368-2516
FAI
Pointe Claire
QC, Canada
(514) 694-7710
(800) 746-4324
Future
Pointe Claire
QC, Canada
(514) 694-7710
(800) 388-8731
Jensen Tools, Inc.
Phoenix, AZ
(602) 968-6241
Marshall Industries, Inc.
El Monte, CA
(808) 307-6000
(800) 432-2223
MCM Electronics
Centerville, OH
(937) 434-0031
(800) 543-4330
Newark Electronics, Inc.
Chicago, IL
(773) 784-5100
(800) 463-9275
NW Test and Measurement
Beaverton, OR
(503) 645-9000
(800) 320-9001
Specialized Products
Irving, TX
(972) 550-1923
(800) 866-5353
Techni-Tool, Inc.
Plymouth Meeting, PA
(610) 825-4990
(800) 382-8665
TESSCO
Sparks, MD
(410) 472-7000
(800) 472-7373
TestEquity, Inc.
Thousand Oaks, CA
(805) 498-9933
(800) 732-3457
Transcat
Rochester, NY
(716) 352-9720
(800) 828-1470
Tucker Electronics
Garland, TX
(214) 348-8800
(800) 527-4642
Zeus Electronics, Inc.
Phoenix, AZ
(602) 263-6022
(800) 528-4512

TELECOM PRODUCTS

ALABAMA

Birmingham
Anixter (Datacom)
(205) 822-8066

ARIZONA

Phoenix
Anixter (Datacom)
(602) 968-7901
Tucson
Anixter (Datacom)
(602) 295-9844

ARKANSAS

Little Rock
Anixter (Datacom)
(501) 223-2824

CALIFORNIA

Anaheim
Anixter (Datacom)
(714) 779-0500
Bakersfield
Anixter (Datacom)
(805) 836-9191
Los Angeles
Anixter (Datacom)
(213) 625-7828
Pleasanton
Anixter (Datacom)
(510) 463-1223
Sacramento
Anixter (Datacom)
(916) 372-1207
San Bernadino
Anixter (Datacom)
(909) 825-7755
San Diego
Anixter (Datacom)
(619) 583-9960
San Francisco
Anixter (Datacom)
(415) 543-6070
Santa Clara
Anixter (Datacom)
(408) 435-1212
Torrance
Anixter (Datacom)
(310) 320-4783
Union City
Anixter (Datacom)
(510) 4899-7100

COLORADO

Denver
Anixter (Datacom)
(303) 373-9200

CONNECTICUT

Branford
RJ Helfernan & Assoc.
(Security)
(203) 488-2235
Cheshire
Anixter (Datacom)
(203) 271-3600
Stamford
Anixter (Datacom)
(203) 325-0390

Representatives/VARs/Video Dealers

TELECOM PRODUCTS
continued

FLORIDA
Dayton
Anixter (Datacom)
(513)-320-0020
Fort Lauderdale
Anixter (Datacom)
(305) 975-7722
Jacksonville
Anixter (Datacom)
(904) 730-2703
Orlando
Anixter (Datacom)
(407) 240-1888
Tampa
Anixter (Datacom)
(813) 626-7115

GEORGIA
Atlanta
Anixter (Datacom)
(404) 921-3732
Lilburn
North Supply Company (Telco)
(404) 925-8727
Stone Mountain
North Supply Company (Telco)
(404) 294-7369

ILLINOIS
Bloomington
Anixter (Datacom)
(309) 452-8572
Chicago
Anixter (Datacom)
(312) 222-0009
Evanston
Anixter (Datacom)
(708) 869-8011
Stokie
Anixter (Datacom)
Brothers, Inc. (Datacom)
(800) 221-5217
(708) 677-6000
Speedpull
Anixter (Datacom)
(708) 597-7100

INDIANA
Indianapolis
Anixter (Datacom)
(317) 243-2008

IOWA
Des Moines
Anixter (Datacom)
(515) 278-1722

KANSAS
Kasnsas City
Anixter (Datacom)
(913) 492-2622

KENTUCKY
Louisville
Anixter (Datacom)
(502) 266-8555

LOUISIANA
Baton Rouge
Anixter (Datacom)
(504) 767-0080
New Orleans
Anixter (Datacom)
(504) 888-5114

MARYLAND
Baltimore
Anixter (Datacom)
(410) 290-7722
Sparks
TESSCO (Cellular)
(800) 638-7666
(410) 472-7352

MASSACHUSETTS
Boston
Anixter (Datacom)
(503) 682-8870
Boston (South)
Anixter (Datacom)
(617) 829-3330
Springfield
Anixter (Datacom)
(413) 731-5100

MICHIGAN
Detroit
Anixter (Datacom)
(810) 473-3900
Grand Rapids
Anixter (Datacom)
(616) 698-7800

MINNESOTA
Minneapolis
Anixter (Datacom)
(612) 542-1804
St. Paul
Anixter (Datacom)
(612) 224-2112

MISSOURI
St. Louis
Anixter (Datacom)
(314) 423-6161

NEBRASKA
Lincoln
Anixter (Datacom)
(402) 466-8337
Omaha
Anixter (Datacom)
(402) 330-7455

NEW HAMPSHIRE
Manchester
Anixter (Datacom)
(603) 556-4416

NEW JERSEY
Princeton
Anixter (Datacom)
(809) 987-9777
Whippany
Anixter (Datacom)
(201) 515-3100

NEW MEXICO
Albuquerque
Anixter (Datacom)
(505) 345-1661

NEW YORK
Albany
Anixter (Datacom)
(518) 464-6251
Brooklyn
Anixter (Datacom)
(718) 821-0065
Buffalo
Anixter (Datacom)
(716) 691-09733
Rochester
Anixter (Datacom)
(716) 426-3440

NORTH CAROLINA
Charleston
Anixter (Datacom)
(803) 572-5526
Charolette
Anixter (Datacom)
(704) 847-5900
Greensboro
Anixter (Datacom)
(910) 655-9131
Raleigh
Anixter (Datacom)
(919) 941-5023

OHIO
Cincinnati
Anixter (Datacom)
(513) 489-21290
Cleveland
Anixter (Datacom)
(216) 546-4400
Columbus
Anixter (Datacom)
(614) 799-2600

OKLAHOMA
Tulsa
Anixter (Datacom)
(918) 664-5558
Jarvis International
(Security)
(913) 437-1100

OREGON
Portland
Anixter (Datacom)
(503) 306-4199

PENNSYLVANIA
Harrisburg
Anixter (Datacom)
(717) 232-6219
Philadelphia
Anixter (Datacom)
(610) 534-3900

PUERTO RICO
Guaynabo
Anixter (Datacom)
(809) 783-6300
San Juan
Telenetworks, Inc.
(809) 766-2829

SOUTH CAROLINA
Columbia
Anixter (Datacom)
(803) 691-9444

TENNESSEE
Memphis
Anixter (Datacom)
(901) 360-8222
Nashville
Anixter (Datacom)
(615) 331-8190

TEXAS
Dallas
Anixter (Datacom)
(214) 446-7337
Houston
Anixter (Datacom)
(713) 460-9473

UTAH
Anixter (Datacom)
(801) 973-4472

VIRGINA
Richmond
Anixter (Datacom)
(804) 527-0866

WASHINGTON
Seattle
Anixter (Datacom)
(206) 251-5287

WASHINGTON DC
Anixter (Datacom)
(703) 818-0150

WEST VIRGINIA
Huntington
Anixter (Datacom)
(304) 733-0845

WISCONSIN
Appleton
Anixter (Datacom)
(414) 730-9309
Milwaukee
Anixter (Datacom)
(414) 355-0222

CATV PRODUCTS

NATIONWIDE
Telewire Supply an Antec Company
Englewood, CO
(888) 353-9473
Jerry Conn Associates
Chambersburg, PA
(800) 233-7600

REPRESENTATIVES

ALASKA
Northwest Test and Measurement
(503) 645-9000

ARKANSAS
Entest
(800) 955-0077

FLORIDA
(North)
EMSCO
(407) 849-6362

HAWAII
Ward/Davis Assoc.

IDAHO
PDX Field Office
(800) 621-1966

KANSAS
Electronics Supply Co.
(816) 931-0250

LOUISANA
Entest
(800) 955-0077

MISSISSIPPI
Entest
(800) 955-0077

MISSOURI
(West)
Electronics Supply Co.
(816) 931-0250

MONTANA
Technology Sales
(801) 572-1588

NEBRASKA
Electronics Supply Co.
(816) 931-0250

NEVADA
Santa Clara Field Office
(800) 538-8125

OKLAHOMA
Entest
(800) 955-0077

UTAH
Technology Sales
(801) 572-1588

WYOMING
Technology Sales
(801) 572-1588

TV TEST PRODUCTS VALUE ADDED RESELLERS (VARS)

Communications Systems Gp
(810) 399-2000
Serves: MI, NW Ohio (Toledo Area)

ALABAMA
C & G Video Systems
(334) 621-1971

ARIZONA
Preco, Inc.
(800) 227-8887

CALIFORNIA
Hoffman Video Systems, Inc.
(818) 507-7116
National Teleconsultants, Inc.
(818) 625-4400
Odetics Broadcast
(714) 774-2200
Phillips, BTS Broadcast TV Systems, Inc.
(805) 584-4724
Snader & Associates, Inc.
(415) 332-7070
Televideo San Diego
(619) 268-1100
VMI, Inc.
(408) 745-1700

COLORADO
Burst Communications, Inc.
(303) 649-9600

CONNECTICUT
HB Communications, Inc.
(203) 234-9246

FLORIDA
BAF Communications
(407) 324-8250
Broadcast International Group
(305) 599-2112
Digital Video Systems (A Division of NuPhase)
(305) 576-3103
Frontline Communications Corp.
(813) 573-0400
Gendra Broadcasting
(305) 372-8845
Harris Corporation
(217) 222-8200
Professional Communications Systems
(800) 447-4714
SKSI System Integration
(813) 556-2701
The Stable Corporation
(407) 259-5893

Rental/Leasing Companies

VALUE ADDED RESELLERS (VARS)

continued

GEORGIA

Technical Industries, Inc. of GA
(770) 455-7610

HAWAII

Video Engineering, Inc.
(808) 847-1088

ILLINOIS

Dwight Cavendish Co.
(847) 673-0937

Roscor Corporation
(847) 299-8080

INDIANA

Broadcast Richmond
(765) 966-6468

Duncan Video, Inc.
(317) 872-0727

MARYLAND

Professional Products, Inc.
(301) 657-2141

MASSACHUSETTS

Beers Associates
(508) 893-3200

Comark Communications, Inc.
(413) 569-0116

Wolf Coach
(508) 791-1950

MICHIGAN

GTN Comm Sys Group
(810) 399-2000

MINNESOTA

AudioVisual Inc. dba AVI Systems
(612) 949-3700

MISSOURI

VMI Company of St. Louis
(314) 569-1334

NEW JERSEY

A. F. Associates
(201) 767-1200

DSI Video Systems, Inc.
(908) 245-4833

East Coast Video Systems
(201) 402-0104

The Systems Group
(201) 795-4672

NEW YORK

All Mobile Video
(212) 727-1234

Audio-Video Corporation
(518) 449-7213

OHIO

Jimmy Rea Electronics
(614) 221-5170

OKLAHOMA

Fairview-AFX, Inc.
(918) 664-8020

PENNSYLVANIA

Lerro Electric Corporation
(610) 650-4100

Peirce-Phelps, Inc.
(215) 879-7244

RPC Video, Inc.
(412) 828-1414

Synergistic Technologies, Inc.
(412) 873-0800

TENNESSEE

Consolidated Media Systems, Inc.
(800) 826-4931

TEXAS

Beck Associates, Inc.
(512-388-9777

Commercial Video Systems, Inc.
(512) 452-1482

Industrial Audio/Video, Inc.
(713) 524-1956

MZB Video Solutions, Inc.
(972) 869-4500

Shook Electronics USA, Inc.
(210) 651-5700

UTAH

Visual Technology, Inc.
(801) 487-6000

VIRGINIA

Communications Engineering, Inc.
(703) 550-5800

FOR CABLE AND TRANSMISSION TEST PRODUCTS

Call Toll Free:
1-800-833-9200

PROFESSIONAL VIDEO DEALERS

ALL THE U.S.

Reeves A/V Systems
(212) 573-8652

WESTERN STATES

Includes: AK, AZ, CA, CO, IA, ID, KS, MN, MT, ND, NE, NM, NV, OK, OR, SD, TX, UT, WA, WI, WY

AVi
(612) 949-3700
Serves: IA, MN, ND, NE, SD, WI

Benson Technical Works, Inc.
(612) 892-1939
Serves: ND, SD, NE, MN, IA, WI

Burst Communications, Inc.
(303) 649-9600
Serves: CO, UT, WY

Ceavco Audio-Visual Co., Inc.
(303) 238-6493
Serves: CO, NM, WY

Dyma Engineering
(800) 222-3962
Serves: AZ, CO, NM, So. KS, OK, TX

Northern Video Systems, Inc.
(916) 575-1700
Serves: No. CA and No. NV

Pacific Video Products, Inc.
(714) 634-8585
Serves: So. CA & Las Vegas

Proline Industris, Inc.
(206) 451-1999
Serves: AK, CA, ID, MT, OR, WA

Videotape Products, Inc.
(213) 664-1144
Serves: Nationwide

Visual Technology
(801) 487-6000
Serves: Nationwide

NORTH CENTRAL STATES

Includes: IA, IL, IN, MI, WI

Swiderski Electronics, Inc.
(708) 364-1900

NEW ENGLAND STATES

Crimson Tech
(617) 499-4637

NEW ENGLAND & NEW YORK

DLE
(508) 947-6801

CONNECTICUT, NEW JERSEY, NEW YORK

Technisphere Corp.
(212) 777-5100

Video Corporation of America
(908) 545-8000
Serves: Metropolitan NYC, NJ, Philadelphia

SOUTHEASTERN U.S.

Technical Video Systems, Inc.
(910) 748-0916

TELCO MANUFACTURERS REPRESENTATIVES

ALASKA

Frigid North
Anchorage, AK
(907) 561-4633

NORTHWESTERN STATES

Includes: ID, OR, MT, WA, and WY

RJM/Ron Moss
(206) 255-8918

SOUTHWESTERN STATES

Includes: AZ, CA, CO, NM, NV, UT

JohnCom
(619) 258-8640
Serves: CA, NV

NORTH CENTRAL STATES

Includes: IA, IL, IN, MI, MN, ND, NE, OH, SD, WI

K-Comm
(612) 639-8675
Serves: IA, IL, MN, ND, SD, WI, MI upper peninsula

Global Sales and Marketing
(614) 895-3030
Serves: IL, IN, MI, OH, WI

SOUTH CENTRAL STATES

Includes: AR, KS, MO, OK, and TX

COLCOM, Inc.
(512) 244-6689
Serves: AR, KS, MO, NE, OK, TX

Strategic Test Solutions, Inc.
(214) 578-0456
Serves: city of Dallas

NORTHEASTERN STATES

Includes: CT, MA, ME, NM, NJ, NY, PA, RI, VT

Data Plus
(610) 429-3220
Serves: DE, NJ, NY, PA

FICO
(508) 649-3337
Serves: CT, MA, ME, NH, RI, VT

SOUTHEASERN STATES

Includes: AL, FL, GA, KY, LA, MD, MS, NC, PA, SC, TN, VA, WV

NDOW, Inc.
(706) 722-6887
Serves: FL, GA, NC, SC

RENTAL/LEASING COMPANIES

AT&T Capital Corporation Instrument and Data Services
Dallas, TX
(800) 874-7123

Continental Resources, Inc.
Bedford, MA
(800) 937-4688

Electro Rent Corporation
Van Nuys, CA
(800) 688-1111

Capital, TEMS

G.E. Rental/Lease
Norcross, GA
(800) GE-RENTS
(800) 437-3687

McGrath RentCorp
San Lorenzo, CA
(800) 352-2900

McGrath RenTelco
Richardson, TX
(800) 233-5807

Telogy, Inc.
Menlo Park, CA
(800) TELOGY-I
(800) 835-6494

Products and Price Listing

PRICE LIST

A01019 ..... $270.00
A01224 ..... $150.00
A01242 ..... $150.00
A01413 ..... $25.00
A01434 ..... $110.00
A02433 ..... $300.00
A02452 ..... $300.00
A02455 ..... $330.00
A02459 ..... $330.00
A02463 ..... $145.00
A02464 ..... $150.00
A02467 ..... $330.00
A02706 ..... $290.00
A02708 ..... $330.00
A02712 ..... $415.00
A02716 ..... $120.00
A02718 ..... $140.00
A02804 ..... $220.00
A02806 ..... $165.00
A08012 ..... $330.00
A08013 ..... $440.00
A08017 ..... $20.00
A08018 ..... $110.00
A08020 ..... $440.00
A08021 ..... $165.00
A08024 ..... $715.00
A08025 ..... $400.00
A08028 ..... $400.00
A08029 ..... $400.00
A08032 ..... $470.00
A08035 ..... $65.00
A08081 ..... $250.00
A08082 ..... $300.00
A08083 ..... $300.00
A08084 ..... $300.00
A08087 ..... $300.00
A08090 ..... $440.00
A08095 ..... $400.00
A08096 ..... $440.00
A08161 ..... $105.00
A08163 ..... $130.00
A09505 ..... $550.00
A09506 ..... $1,400.00
A09507 ..... $140.00
A1001 ..... $150.00
A1002 ..... $250.00
A1003 ..... $250.00
A1004 ..... $250.00
A1005 ..... $260.00
A1007 ..... $410.00
A1009 ..... $400.00
A1010 ..... $595.00
A1023 ..... $375.00
A1024 ..... $375.00
A605 ..... $90.00
A610 ..... $195.00
A621 ..... $390.00
A622 ..... $415.00
A6302 ..... $850.00
Opt. 96 ..... $50.00
A6302XL $1,195.00
A6303 ..... $1,695.00
A6303XL $1,995.00
A6304XL $2,195.00
A6312 ..... $995.00
A6906S $8,000.00
Opt. 01 ..... $220.00
Opt. 02 ..... $1,295.00
Opt. 03 ..... $2,695.00
Opt. 04 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
A6907 ..... $7,650.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
A6909 ..... $3,995.00
Opt. 10 ..... $295.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
AC11 ..... $33.00
AC12 ..... $37.00
AC13 ..... $27.00
AC220 ..... $65.00
ACL21 ..... $12.00
ACL22 ..... $19.00
ACL23 ..... $21.00
ACL24 ..... $25.00
ADA400A $995.00
Opt. 96 ..... $50.00
ADS-B1 ..... $1,705.00
ADSRS $19,950.00
Opt. 01 ..... $1,705.00
Opt. 95 ..... $220.00
ADSRSZ2 ..... $865.00
AFG2020 ..... $9,550.00
AFG202002 ..... $3,950.00
AFG20201R $495.00
AFG20201S $695.00
AFG202095 ..... $150.00
AFG2020A1 ..... $0.00
AFG2020A2 ..... $0.00
AFG2020A3 ..... $0.00
AFG2020A4 ..... $0.00
AFG2020A5 ..... $0.00
AFG2020B1 ..... $150.00
AFTDS $495.00
Opt. 95 ..... $150.00
AGL1 ..... $1,550.00
Opt. 95 ..... $0.00
Opt. 96 ..... $0.00
AM5030 ..... $2,250.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
AM5030S $4,295.00
Opt. 02 ..... $375.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
AM503B $1,895.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
AM503S $3,095.00
Opt. 01 ..... $1,495.00
Opt. 03 ..... $695.00
Opt. 05 ..... $145.00
Opt. 09 ..... –$735.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
AM524 ..... $43,350.00
AM70 ..... $1,995.00
Opt. 01 ..... $75.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A6 ..... $0.00
AM700 ..... $17,500.00
Opt. 1F $1,900.00
Opt. 1M $1,900.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
AM7FR1 ..... $295.00
AMT75 ..... $230.00
Opt. 95 ..... $150.00
ASG100 ..... $2,100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
ASG140 ..... $2,200.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
ASW100F $2,195.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
ASW100M $2,195.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
ATK01 ..... $14.00
ATL01 ..... $9.00
ATL21 ..... $17.00
ATL22 ..... $9.00
ATL23 ..... $12.00
ATLDX1 ..... $69.00
ATM150 ..... $30,750.00
Opt. 03 ..... $5,295.00
Opt. 05 ..... $3,995.00
Opt. 1M $200.00
Opt. 3C $0.00
Opt. 4C $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
ATP01 ..... $12.00
AVG1 ..... $3,050.00
Opt. 95 ..... $0.00
Opt. 96 ..... $0.00
AVTIME $1.00
Opt. 01 ..... $31,300.00
Opt. 02 ..... $31,300.00
Opt. 11 ..... $30,800.00
Opt. 12 ..... $30,800.00
AWDK1 ..... $3,065.00
AWG2005 ..... $8,495.00
Opt. 02 ..... $4,495.00
Opt. 04 ..... $1,895.00
Opt. 05 ..... $1,895.00
Opt. 09 ..... $2,495.00
Opt. 1R $595.00
Opt. 1S $695.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. B1 ..... $150.00
AWG2021 ..... $11,995.00
Opt. 02 ..... $4,395.00
Opt. 03 ..... $1,895.00
Opt. 04 ..... $1,895.00
Opt. 09 ..... $2,495.00
Opt. 1R $595.00
Opt. 1S $695.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. B1 ..... $150.00
AWG2041 ..... $19,995.00
Opt. 01 ..... $4,695.00
Opt. 03 ..... $2,495.00
Opt. 09 ..... $2,495.00
Opt. 1R $595.00
Opt. 1S $695.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. B1 ..... $150.00
C1850G $1,695.00
Opt. 01 ..... $90.00
Opt. 02 ..... $90.00
Opt. 03 ..... $190.00
Opt. 04 ..... $90.00
Opt. 05 ..... $225.00
Opt. 06 ..... $90.00
C2P2-SC $2,655.00
C3280 ..... $7,650.00
C48P2SC $2,860.00
CADLINK $1,600.00
CADLINK3M $1,100.00
CAL4100 ..... $55.00
CAL4200 ..... $65.00
CAL4300 ..... $95.00
CAL4400 ..... $145.00
CAL4500 ..... $210.00
CAL4600 ..... $245.00
CAL4700 ..... $470.00
CAL4800 ..... $890.00
CATV $36,660.00
CATVK1 ..... $1,980.00
CDM250 ..... $399.00
CFG253 ..... $420.00
Opt. 96 ..... $50.00
CFG280 ..... $1,030.00
Opt. 96 ..... $50.00
CMC251 ..... $620.00
CMD-B1 ..... $1,065.00
CMD-B14 ..... $2,500.00
CMD-B17 ..... $5,000.00
CMD-B19 ..... $3,425.00
CMD-B2 ..... $1,575.00
CMD-B3 ..... $250.00
CMD-B4 ..... $3,105.00
CMD-B41 ..... $1,375.00
CMD-B42 ..... $1,495.00
CMD-B43 ..... $1,625.00
CMD-B5 ..... $820.00
CMD-B6 ..... $725.00

**1 Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

CMD-B60 ..... $730.00
CMD-B61 ..... $370.00
CMD-B62 ..... $490.00
CMD-B7 ..... $8,750.00
CMD-B8 ..... $4,500.00
CMD-K13 ..... $2,975.00
CMD-K43 ..... $630.00
CMD-K51 ..... $525.00
CMD-U10 ..... $895.00
CMD-U11 ..... $1,715.00
CMD-U12 ..... $1,015.00
CMD-U3 ..... $2,500.00
CMD-U5 ..... $400.00
CMD-U8 ..... $6,125.00
CMD-UK2 ..... $8,005.00
CMD-Z1 ..... $270.00
CMD-Z10 ..... $1,160.00
CMD-Z20 ..... $195.00
CMD-Z40 ..... $540.00
CMD-Z50 ..... $175.00
CMD50 ..... $20,250.00
Opt. 1R $185.00
Opt. 95 ..... $310.00
Opt. B1 ..... $1,065.00
Opt. B3 ..... $250.00
Opt. B4 ..... $3,105.00
Opt. B41 ..... $1,330.00
Opt. B42 ..... $1,385.00
Opt. B6 ..... $725.00
Opt. B62 ..... $490.00
Opt. U5 ..... $400.00
CMD52 ..... $30,400.00
Opt. 1R $185.00
Opt. 95 ..... $310.00
Opt. B1 ..... $1,065.00
Opt. B3 ..... $250.00
Opt. B4 ..... $3,150.00
Opt. B41 ..... $1,375.00
Opt. B42 ..... $1,495.00
Opt. B6 ..... $725.00
Opt. B61 ..... $370.00
Opt. B62 ..... $490.00
Opt. Z2 ..... $215.00
CMD53 ..... $22,950.00
Opt. 1R $185.00
Opt. 95 ..... $310.00
Opt. B1 ..... $1,065.00
Opt. B19 ..... $3,425.00
Opt. B20 ..... $650.00
Opt. B3 ..... $250.00
Opt. B30 ..... $1,260.00
Opt. B4 ..... $3,105.00
Opt. B41 ..... $1,375.00
Opt. B42 ..... $1,495.00
Opt. B43 ..... $1,510.00
Opt. B6 ..... $725.00
Opt. B62 ..... $490.00
Opt. U5 ..... $400.00
Opt. U56 ..... $10,525.00
CMD55 ..... $32,250.00
Opt. 1R $185.00
Opt. 95 ..... $310.00
Opt. B1 ..... $1,035.00
Opt. B19 ..... $3,425.00
Opt. B2 ..... $1,575.00
Opt. B3 ..... $250.00
Opt. B4 ..... $3,150.00
Opt. B41 ..... $1,375.00
Opt. B42 ..... $1,495.00
Opt. B43 ..... $1,625.00
Opt. B5 ..... $820.00
Opt. B6 ..... $725.00
Opt. B61 ..... $370.00
Opt. B62 ..... $490.00
Opt. K43 ..... $630.00
Opt. U5 ..... $400.00
Opt. U56 ..... $10,525.00
Opt. Z2 ..... $215.00
CMD57 ..... $36,750.00
Opt. 1R $185.00
Opt. 43 ..... $630.00
Opt. 95 ..... $310.00
Opt. B1 ..... $1,065.00
Opt. B19 ..... $3,425.00
Opt. B2 ..... $1,575.00
Opt. B3 ..... $250.00
Opt. B41 ..... $1,375.00
Opt. B5 ..... $820.00
Opt. B6 ..... $725.00
Opt. B61 ..... $370.00
Opt. B62 ..... $490.00
Opt. B7 ..... $7,500.00
Opt. B8 ..... $4,500.00
Opt. K11 ..... $4,375.00
Opt. K13 ..... $2,975.00
Opt. K51 ..... $525.00
Opt. U3 ..... $2,500.00
Opt. U5 ..... $400.00
Opt. U8 ..... $6,125.00
Opt. U9 ..... $2,485.00
CMD59 ..... $28,915.00
Opt. 1R $185.00
Opt. 95 ..... $310.00
Opt. B1 ..... $1,035.00
Opt. B2 ..... $1,575.00
Opt. B3 ..... $250.00
Opt. B41 ..... $1,330.00
Opt. B5 ..... $820.00
Opt. B6 ..... $705.00
Opt. B61 ..... $345.00
Opt. B62 ..... $465.00
Opt. B7 ..... $7,500.00
Opt. B8 ..... $4,500.00
Opt. K11 ..... $4,375.00
Opt. K13 ..... $2,975.00
Opt. K43 ..... $630.00
Opt. K51 ..... $525.00
Opt. U3 ..... $2,500.00
Opt. U8 ..... $6,125.00
CMD60 ..... *1
Opt. 1R $185.00
Opt. 95 ..... $310.00
Opt. B1 ..... $1,065.00
Opt. B3 ..... $250.00
Opt. B6 ..... $725.00
Opt. B61 ..... $370.00
CMD80 ..... $49,000.00
Opt. 01 ..... $1,035.00
Opt. 02 ..... $2,500.00
Opt. 03 ..... $250.00
Opt. 04 ..... $705.00
Opt. 07 ..... $345.00
Opt. 08 ..... $465.00
Opt. 14 ..... $2,500.00
Opt. 15 ..... –$8,005.00
Opt. 16 ..... –$8,005.00
Opt. 17 ..... $5,000.00
Opt. 18 ..... $900.00
Opt. 1R $185.00
Opt. 95 ..... $310.00
CMDAZ1 ..... $1,950.00
CMM150 ..... $45.00
CMP500 ..... $63,350.00
Opt. 01 ..... $1,950.00
Opt. 20 ..... $0.00
Opt. 40 ..... $4,395.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
CMS-Z37 ..... $340.00
CMS54 ..... $20,306.00
Opt. 01 ..... $1,075.00
Opt. 02 ..... $1,895.00
Opt. 03 ..... $1,355.00
Opt. 06 ..... $1,820.00
Opt. 07 ..... $4,175.00
Opt. 08 ..... $204.00
Opt. 09 ..... $1,375.00
Opt. 10 ..... $980.00
Opt. 11 ..... $1,040.00
Opt. 12 ..... $1,125.00
Opt. 13 ..... $845.00
Opt. 14 ..... $540.00
Opt. 15 ..... $630.00
Opt. 16 ..... $310.00
Opt. 17 ..... $1,495.00
Opt. 18 ..... $2,465.00
Opt. 19 ..... $120.00
Opt. 22 ..... $590.00
Opt. 23 ..... $6,740.00
Opt. 27 ..... $3,021.00
Opt. 95 ..... $310.00
CMS57 ..... $25,870.00
Opt. 01 ..... $1,075.00
Opt. 02 ..... $1,895.00
Opt. 03 ..... $1,355.00
Opt. 04 ..... $2,165.00
Opt. 06 ..... $1,820.00
Opt. 07 ..... $4,175.00
Opt. 08 ..... $205.00
Opt. 09 ..... $1,390.00
Opt. 10 ..... $980.00
Opt. 11 ..... $1,040.00
Opt. 12 ..... $646.00
Opt. 13 ..... $845.00
Opt. 14 ..... $540.00
Opt. 15 ..... $645.00
Opt. 16 ..... $310.00
Opt. 17 ..... $1,495.00
Opt. 18 ..... $2,465.00
Opt. 19 ..... $120.00
Opt. 22 ..... $590.00
Opt. 23 ..... $6,740.00
Opt. 24 ..... $1,365.00
Opt. 27 ..... $2,007.00
Opt. 95 ..... $310.00
CMSZ1 ..... $190.00
CMSZ2 ..... $460.00
CMSZ5 ..... $105.00
CMSZ7 ..... $50.00
CMT54 ..... $33,836.40
Opt. 01 ..... $885.00
Opt. 02 ..... $1,159.60
Opt. 03 ..... $1,160.00
Opt. 04 ..... $2,594.80
Opt. 05 ..... $1,075.00
Opt. 10 ..... $1,455.00
Opt. 11 ..... $3,350.00
Opt. 12 ..... $800.00
Opt. 13 ..... $2,495.00
Opt. 20 ..... $6,935.00
Opt. 30 ..... $565.00
Opt. 31 ..... $2,390.00
Opt. 95 ..... $325.00
CMT55 ..... $44,200.00
Opt. 01 ..... $885.00
Opt. 02 ..... $1,159.60
Opt. 03 ..... $1,160.00
Opt. 04 ..... $2,594.80
Opt. 05 ..... $1,075.00
Opt. 10 ..... $1,455.00
Opt. 11 ..... $3,355.00
Opt. 12 ..... $800.00
Opt. 30 ..... $640.00
Opt. 31 ..... $2,995.20
Opt. 95 ..... $325.00
CMT84 ..... $47,580.00
Opt. 01 ..... $885.00
Opt. 02 ..... $1,159.60
Opt. 03 ..... $1,160.00
Opt. 06 ..... $10,644.40
Opt. 07 ..... $1,225.00
Opt. 11 ..... $3,355.00
Opt. 12 ..... $800.00
Opt. 30 ..... $639.60
Opt. 31 ..... $2,995.20
CMTA-B9 ..... $3,350.00
CMTA54 ..... $51,480.00
Opt. 03 ..... $1,160.00
Opt. 10 ..... $1,460.00
Opt. 11 ..... $3,355.00
Opt. 20 ..... $8,095.00
Opt. 21 ..... $1,075.00
Opt. 22 ..... $3,485.00
Opt. 31 ..... $2,995.00
CMTA84 ..... $64,220.00
Opt. 03 ..... $1,155.00
Opt. 06 ..... $2,430.00
Opt. 07 ..... $1,225.00
Opt. 11 ..... $3,355.00
Opt. 21 ..... $1,075.00
Opt. 31 ..... $3,015.00
Opt. 95 ..... $325.00
CMTA94 ..... *1
Opt. 95 ..... $310.00
CMZ1 ..... $295.00
CMZ20 ..... $2,495.00
CMZ39 ..... $1,290.00
CMZ5 ..... $495.00
CPK52SC $2,205.00
CPK53SC $2,205.00
CPK54SC $2,205.00
CPK55SC $3,020.00
CPK56SC $1,420.00
CPK58SC $2,450.00
CPK59SC $1,225.00
CPK62SC $2,205.00
CPK63SC $2,205.00
CPK64SC $2,205.00
CPK65SC $3,020.00
CPK66SC $1,420.00
CPK68SC $2,450.00
CPK69SC $1,225.00
CPS250 ..... $495.00
CR02PH2 ..... $23,865.00
CR04PH2 ..... $23,865.00
CR48PH2 ..... $25,700.00
CRT-1T $5,105.00
CRT-2T $10,960.00
CRT-K3 ..... $6,355.00
CRTC02 ..... $249,650.00
Opt. 1T $5,105.00
Opt. 95 ..... $500.00
Opt. B1 ..... $4,885.00
Opt. B7 ..... $3,500.00
Opt. Z2 ..... $200.00
CRTC04 ..... $237,765.00
Opt. 1T $5,101.00
Opt. 95 ..... $500.00
Opt. B1 ..... $4,650.00
Opt. B5 ..... $2,975.00
Opt. B7 ..... $3,500.00
Opt. Z2 ..... $200.00
CRTP-B7 ..... $3,675.00
CRTP-K56 ..... $12,550.00
CRTP-K59 ..... $11,015.00
CRTP02 ..... $243,445.00
Opt. 01 ..... $4,885.00
Opt. 1T $5,101.00
Opt. 95 ..... $500.00
Opt. B7 ..... $3,500.00
CRTPK22 ..... $32,735.00
CRTPK23 ..... $29,460.00

*1 *Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

CRTPK24 ..... $32,735.00
CRTPK26 ..... $4,915.00
CRTPK52 ..... $19,835.00
CRTPK53 ..... $19,835.00
CRTPK54 ..... $19,835.00
CRTPK55 ..... $27,170.00
CRTPK58 ..... $22,030.00
CRTPK59 ..... $11,015.00
CRTPK5A $11,300.00
CRTPK62 ..... $19,835.00
CRTPK63 ..... $19,835.00
CRTPK64 ..... $19,835.00
CRTPK65 ..... $27,170.00
CRTPK68 ..... $22,030.00
CRTPK69 ..... $11,015.00
CRTPK6A $11,300.00
CRTS-B5 ..... $2,975.00
CRTS-K2 ..... $5,559.00
CRTSK1 ..... $6,005.00
CRTSK2 ..... $5,840.00
CRTSK22 ..... $22,465.00
CRTSK23 ..... $20,070.00
CRTSK24 ..... $28,090.00
CRTSK26 ..... $4,135.00
CRTSK28 ..... $53,970.00
CRTSK38 ..... $22,030.00
CRTSK48 ..... $28,090.00
CRTU1 ..... $3,875.00
CRTZ2 ..... $200.00
CSA803A $25,000.00
Opt. 10 ..... –$1,000.00
Opt. 1R $250.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
CSS500 ..... $2,050.00
CT1 ..... $335.00
Opt. 09 ..... –$100.00
CT100 ..... $2,795.00
Opt. 2A $495.00
Opt. 3B $495.00
Opt. 46 ..... $50.00
CT12AF $495.00
CT12BF $895.00
CT13BF $495.00
CT2 ..... $310.00
Opt. 09 ..... –$100.00
CT4 ..... $1,895.00
CTD-Z10 ..... $675.00
CTD55 ..... $6,425.00
Opt. B5 ..... $0.00
CTS55 ..... $11,250.00
Opt. 95 ..... $200.00
Opt. B1 ..... $825.00
CTS710 ..... $16,290.00
Opt. 03 ..... $7,790.00
Opt. 04 ..... $10,500.00
Opt. 05 ..... $10,500.00
Opt. 06 ..... $21,000.00
Opt. 22 ..... $5,990.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
CTS750 ..... $16,290.00
Opt. 03 ..... $7,790.00
Opt. 04 ..... $10,500.00
Opt. 05 ..... $10,500.00
Opt. 06 ..... $21,000.00
Opt. 11 ..... $200.00
Opt. 14 ..... $8,000.00
Opt. 36 ..... $8,290.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
CTS7F01 ..... $1,900.00
Opt. 96 ..... $50.00
CTS7F03 ..... $8,500.00
Opt. 96 ..... $50.00
CTS7F04 ..... $17,900.00
Opt. 96 ..... $50.00
CTS7F05 ..... $21,900.00
Opt. 96 ..... $50.00
CTS7F14 ..... $9,000.00
CTS7F22 ..... $6,600.00
CTS7F36 ..... $8,600.00
CTS7U14 ..... $11,500.00
CVS1N $5,995.00
DAS9221 ..... $10,800.00
Opt. 04 ..... $1,500.00
Opt. 05 ..... $630.00
Opt. 18 ..... $380.00
Opt. 1A $0.00
Opt. 1B $800.00
Opt. 2C $2,200.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
DAS92E9 ..... $7,250.00
Opt. 05 ..... $630.00
Opt. 1A $0.00
Opt. 1B $800.00
Opt. 2C $2,200.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
DASMTIF $2,000.00
DASNT $12,400.00
Opt. 04 ..... $1,500.00
Opt. 05 ..... $630.00
Opt. 18 ..... $380.00
Opt. 1A $0.00
Opt. 1B $800.00
Opt. 2C $2,200.00
Opt. 3X $2,900.00
Opt. 4X $4,800.00
Opt. 5C $0.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
DASXP $12,400.00
Opt. 04 ..... $1,500.00
Opt. 05 ..... $630.00
Opt. 18 ..... $380.00
Opt. 1A $0.00
Opt. 1B $800.00
Opt. 2C $2,200.00
Opt. 4X $1,900.00
Opt. 5C $0.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
DBS8700 ..... $4,395.00
Opt. 10 ..... $0.00
Opt. 11 ..... $0.00
Opt. 96 ..... $50.00
Opt. X1 ..... $505.00
DBS8701 ..... $5,095.00
Opt. 10 ..... $0.00
Opt. 11 ..... $0.00
Opt. 96 ..... $50.00
Opt. X1 ..... $595.00
DBS8710 ..... $4,125.00
Opt. 10 ..... $0.00
Opt. X1 ..... $470.00
DBS8720 ..... $1,575.00
Opt. 10 ..... $0.00
Opt. X1 ..... $180.00
DBS8750 ..... $4,350.00
Opt. 96 ..... $50.00
Opt. X1 ..... $505.00
DBS8751 ..... $3,995.00
Opt. 96 ..... $50.00
Opt. X1 ..... $455.00
DBS8752 ..... $3,995.00
Opt. 96 ..... $50.00
Opt. X1 ..... $455.00
DCM300 ..... $109.00
DCM320 ..... $139.00
DCM910 ..... $225.00
DCS1000 ..... $32,800.00
Opt. 01 ..... –$3,400.00
Opt. 02 ..... –$4,300.00
Opt. 03 ..... $17,250.00
Opt. 1R $340.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
DDS200 ..... $23,900.00
Opt. 1R $90.00
Opt. 2R $0.00
Opt. 90 ..... $0.00
DG2020 ..... $10,495.00
Opt. 01 ..... $3,995.00
Opt. 02 ..... $6,995.00
Opt. 1R $595.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
DL11 ..... $4,295.00
DMM150 ..... $69.00
DMM157 ..... $99.00
DMM249 ..... $160.00
DMM254 ..... $260.00
DMM912 ..... $199.00
Opt. 1L $0.00
Opt. 96 ..... $50.00
DMM914 ..... $249.00
Opt. 1L $0.00
Opt. 96 ..... $50.00
DMM916 ..... $289.00
Opt. 1L $0.00
Opt. 96 ..... $50.00
DNF20 ..... $418.00
DS1001 ..... $3,900.00
DS1200 ..... $13,125.00
DTM900 ..... $99.00
DTM920 ..... $149.00
DVG1 ..... $2,150.00
Opt. 95 ..... $0.00
Opt. 96 ..... $0.00
Opt. S1 ..... $750.00
DVT200 ..... $45,500.00
Opt. 1R $95.00
Opt. 90 ..... $0.00
ECO170A $2,725.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
ECO422 ..... $2,600.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
EMC120 ..... $2,450.00
EMC120U $950.00
EMFTBG5 ..... $19,100.00
ESAI $68,725.00
Opt. 01 ..... $4,295.00
Opt. 02 ..... $2,795.00
Opt. 95 ..... $496.00
ESBI $76,900.00
Opt. 01 ..... $5,095.00
Opt. 95 ..... $500.00
ESH2Z1 ..... $1,325.00
Opt. 95 ..... $270.00
ESH2Z11 ..... $705.00
ESH2Z2 ..... $1,520.00
ESH2Z3 ..... $1,390.00
ESH2Z31 ..... $270.00
ESH2Z5 ..... $9,950.00
Opt. 95 ..... $350.00
ESH3Z2 ..... $450.00
ESH3Z3 ..... $1,735.00
ESH3Z4 ..... $1,220.00
Opt. 95 ..... $310.00
ESH3Z5 ..... $2,450.00
Opt. 95 ..... $310.00
ESH3Z6 ..... $1,830.00
Opt. 95 ..... $250.00
ESHS10 ..... $27,300.00
Opt. 1R $200.00
Opt. 95 ..... $385.00
ESHS20 ..... $37,950.00
ESHS30 ..... $35,000.00
Opt. 1R $200.00
Opt. 95 ..... $465.00
ESK1 ..... $3,950.00
ESK10 ..... $4,850.00
ESK100 ..... $5,590.00
ESK11 ..... $4,765.00
ESK12 ..... $4,765.00
ESK13 ..... $4,765.00
ESK14 ..... $6,070.00
ESK15 ..... $4,765.00
ESK1F $0.00
ESK2 ..... $4,675.00
ESK30 ..... $4,765.00
ESK31 ..... $4,765.00
ESK32 ..... $4,765.00
ESK33 ..... $4,765.00
ESK34 ..... $4,765.00
ESK35 ..... $3,240.00
ESK36 ..... $3,240.00
ESK50 ..... $1,610.00
ESK80 ..... $1,825.00
ESMI $109,500.00
Opt. 95 ..... $538.00
ESMI-B1 ..... $29,590.00
ESMI-Z7 ..... $2,800.00
ESN $75,800.00
ESN 01 ..... $9,495.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 1R	$200.00
Opt. 95	$395.00
ESPC	$26,950.00
Opt. 1R	$200.00
Opt. 95	$350.00
Opt. B1	$360.00
Opt. B2	$1,950.00
Opt. B3	$3,950.00
ESS	$83,450.00
Opt. 01	$3,250.00
Opt. 95	$482.00
ESVB	$49,500.00
Opt. 01	$3,995.00
Opt. 02	$5,750.00
Opt. 95	$340.00
ESVD	$45,600.00
Opt. 01	$4,080.00
Opt. 02	$5,865.00
Opt. 95	$340.00
ESVN20	$48,700.00
Opt. 01	$3,250.00
Opt. 95	$465.00
ESVN30	$55,050.00
Opt. 01	$3,250.00
Opt. 95	$465.00
ESVS10	$30,100.00
Opt. 01	$1,505.00
Opt. 95	$385.00
ESVS30	$44,250.00
Opt. 01	$1,505.00
Opt. 95	$453.00
ESVZ1	$1,750.00
Opt. 95	$243.00
ESVZ3	$2,175.00
EZ1002	$2,475.00
EZ1003	$2,475.00
EZ11	$110.00
EZ12	$2,100.00
EZ13	$335.00
EZ14	$355.00
EZ15	$95.00
EZ1702	$1,590.00
EZ1703	$1,590.00
EZ18	$3,560.00
EZ19	$85.00
EZ4	$360.00
EZ402	$320.00
EZ5	$360.00
EZ502	$350.00
EZ6	$360.00
EZ8	$1,325.00
FG1300	$11,800.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$0.00
Opt. 39	$0.00
Opt. 95	$150.00
FG1315	$14,000.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$0.00
Opt. 39	$0.00
Opt. 95	$150.00
FL1315	$23,000.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$0.00
Opt. 39	$0.00
Opt. 95	$150.00
FL1500	$17,750.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$0.00
Opt. 39	$0.00
Opt. 42	$0.00
Opt. 95	$150.00
FM8500	$8,500.00
Opt. 20	$0.00
Opt. 21	$0.00
Opt. 22	$0.00
Opt. 23	$0.00
Opt. 24	$0.00
Opt. 25	$0.00
Opt. 26	$0.00
Opt. 27	$0.00
Opt. 28	$0.00
Opt. 29	$0.00
Opt. 95	$150.00
FM8513	$16,500.00
Opt. 20	$0.00
Opt. 21	$0.00
Opt. 22	$0.00
Opt. 23	$0.00
Opt. 24	$0.00
Opt. 25	$0.00
Opt. 26	$0.00
Opt. 27	$0.00
Opt. 28	$0.00
Opt. 29	$0.00
Opt. 95	$150.00
FMA	$28,150.00
Opt. 01	$2,190.00
Opt. 02	$2,785.00
Opt. 03	$3,400.00
Opt. 05	$3,830.00
Opt. 07	$3,755.00
Opt. 08	$13,600.00
Opt. 09	$1,835.00
Opt. 10	$10,125.00
Opt. 1R	$195.00
Opt. 95	$350.00
FMAB	$35,700.00
Opt. 05	$3,830.00
Opt. 07	$4,385.00
Opt. 08	$13,600.00
Opt. 09	$1,835.00
Opt. 10	$10,125.00
Opt. 1R	$195.00
Opt. 95	$350.00
FMAS	$58,435.00
FMAV	$34,925.00
Opt. 01	$2,190.00
Opt. 02	$2,785.00
Opt. 03	$3,415.00
Opt. 05	$3,835.00
Opt. 08	$13,600.00
Opt. 95	$350.00
FMAZ1	$3,255.00
FMB	$35,700.00
Opt. 01	$2,190.00
Opt. 02	$2,785.00
Opt. 03	$3,415.00
Opt. 05	$3,835.00
Opt. 07	$4,385.00
Opt. 08	$13,600.00
Opt. 09	$1,835.00
Opt. 10	$10,125.00
Opt. 1R	$195.00
Opt. 95	$350.00
FMTAP	$995.00
FMTAP SL	$6,505.00
FS1300	$16,500.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$0.00
Opt. 39	$0.00
Opt. 41	$0.00
Opt. 42	$0.00
Opt. 95	$150.00
FS1315	$23,000.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$0.00
Opt. 39	$0.00
Opt. 41	$0.00
Opt. 42	$0.00
Opt. 95	$150.00
FS1500	$17,500.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$0.00
Opt. 39	$0.00
Opt. 41	$0.00
Opt. 42	$0.00
Opt. 95	$150.00
FS156	$913.00
FS52	$811.00
FS622	$1,015.00
FSE-B15	$2,740.00
FSE-B2	$14,000.00
FSE-B7	$17,600.00
FSE-K3	$4,495.00
FSE-Z1	$900.00
FSE-Z3	$290.00
FSEA20	$29,995.00
Opt. 01	$2,950.00
Opt. 02	$14,000.00
Opt. 04	$4,465.00
Opt. 07	$17,600.00
Opt. 15	$2,740.00
Opt. 16	$1,375.00
Opt. 17	$1,375.00
Opt. 1R	$200.00
Opt. 49	$1,375.00
Opt. 95	$310.00
Opt. B12	$2,750.00
Opt. B22	$1,250.00
Opt. B8	$10,250.00
Opt. B9	$13,500.00
FSEA30	$45,575.00
Opt. 02	$14,000.00
Opt. 07	$17,600.00
Opt. 15	$2,740.00
Opt. 16	$1,375.00
Opt. 17	$1,375.00
Opt. 1R	$200.00
Opt. 49	$1,375.00
Opt. 95	$310.00
Opt. B12	$2,750.00
Opt. B22	$1,250.00
Opt. B8	$10,250.00
Opt. B9	$13,500.00
FSEB20	$34,995.00
Opt. 01	$2,950.00
Opt. 04	$4,465.00
Opt. 07	$17,600.00
Opt. 15	$2,740.00
Opt. 16	$1,375.00
Opt. 17	$1,375.00
Opt. 1R	$200.00
Opt. 49	$1,375.00
Opt. 95	$310.00
Opt. B10	$12,950.00
Opt. B11	$16,195.00
Opt. B12	$2,750.00
Opt. B22	$1,250.00
FSEB30	$49,995.00
Opt. 07	$17,600.00
Opt. 15	$2,740.00
Opt. 16	$1,375.00
Opt. 17	$1,375.00
Opt. 1R	$200.00
Opt. 49	$1,375.00
Opt. 95	$310.00
Opt. B10	$12,950.00
Opt. B11	$16,195.00
Opt. B12	$2,750.00
Opt. B22	$1,250.00
Opt. C3	$3,405.00
Opt. D3	$1,115.00
Opt. D5	$1,790.00
Opt. R3	$2,160.00
Opt. R5	$4,165.00
FSEM20	$41,400.00
Opt. 1R	$200.00
Opt. 49	$1,375.00
Opt. 95	$460.00
Opt. B1	$2,950.00
Opt. B15	$2,740.00
Opt. B16	$1,375.00
Opt. B17	$1,375.00
Opt. B22	$1,250.00
Opt. B4	$4,465.00
Opt. B7	$17,600.00
FSEM30	$55,000.00
Opt. 1R	$200.00
Opt. 49	$1,375.00
Opt. 95	$460.00
Opt. B10	$12,950.00
Opt. B11	$16,195.00
Opt. B12	$2,750.00
Opt. B15	$2,740.00
Opt. B16	$1,375.00
Opt. B17	$1,375.00
Opt. B22	$1,250.00
Opt. B7	$17,600.00
FSTIP	$125.00
GB1400	$53,500.00
Opt. 02	$1,995.00
Opt. 05	$4,000.00
Opt. 07	$2,000.00
Opt. 08	$9,500.00
Opt. 09	$3,995.00
Opt. 2M	$400.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 4S	$1,000.00
Opt. 95	$650.00
Opt. A3	$0.00
GB1400R	$27,975.00
Opt. 02	$800.00
Opt. 05	$2,200.00
Opt. 08	$5,000.00
Opt. 09	$2,100.00
Opt. 1M	$200.00
Opt. 4S	$1,000.00
Opt. A3	$0.00
GB1400T	$29,750.00
Opt. 02	$800.00
Opt. 05	$2,200.00
Opt. 07	$2,200.00
Opt. 08	$5,000.00
Opt. 09	$2,100.00
Opt. 1M	$200.00
Opt. 4S	$1,000.00
Opt. A3	$0.00
GB140U8	$12,500.00
GB14RU8	$6,500.00
GB14TU8	$6,500.00
GB700	$40,500.00
Opt. 02	$2,000.00
Opt. 2M	$400.00
Opt. 4S	$1,000.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
GB700R	$21,850.00
Opt. 02	$1,100.00
Opt. 1M	$200.00
Opt. 4S	$1,000.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A5	$0.00
GB700T	$21,850.00
Opt. 02	$1,100.00
Opt. 1M	$200.00
Opt. 4S	$1,000.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A5	$0.00
CRF00	$350.00
GP1	$800.00
Opt. 96	$50.00
HC411	$470.00
Opt. 03	$58.00
Opt. 04	$45.00
Opt. A1	$0.00
HCC	$8,325.00
HCMB1	$1,550.00
HCMB2	$3,075.00
HCMB3	$775.00
HCMF04	$17,250.00
HCMF06	$18,100.00
HCMM04	$19,350.00
HCMM06	$20,250.00
HCT1202	$15,850.00
HCT1203	$12,850.00
HFH2Z1	$6,875.00
Opt. 95	$243.00
HFH2Z2	$6,500.00
Opt. 95	$243.00
HFH2Z4	$700.00
HFH2Z6	$3,200.00
Opt. 95	$243.00
HFS9003	$16,000.00
Opt. 01	$995.00
Opt. 1R	$300.00
Opt. 95	$150.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
HFS9009	$25,000.00
HFS900901	$995.00
HFS900995	$150.00
HFS9009A1	$0.00
HFS9009A2	$0.00
HFS9009A3	$0.00
HFS9009A4	$0.00
HFS9009A5	$0.00
HFS9DG1	$12,400.00
Opt. 95	$150.00
HFS9DG2	$8,900.00
Opt. 95	$150.00
HFU2Z4	$850.00
HFU2Z5	$665.00
HFUMZ 02	$8,275.00
HFUTZ 02	$2,575.00
HFVZ	$325.00
HK116	$2,550.00
HL023A1	$4,200.00
HL223	$2,850.00
Opt. Z1	$740.00
HM020	$8,025.00
Opt. Z1	$1,150.00
Opt. Z2	$595.00
Opt. Z3	$2,750.00
HM525	$16,850.00
HM525Z1	$450.00
HUFZ1	$2,800.00
Opt. 95	$425.00
HUFZ4	$3,300.00
Opt. 95	$243.00
HZ1	$850.00
HZ10	$690.00
HZ1102	$1,395.00
HZ12	$5,260.00
HZ13	$4,950.00
HZ14	$5,300.00
HZ16	$0.00
HZ18	$245.00
HZ19	$265.00
HZ3	$325.00
HZ4	$350.00
HZ9	$1,850.00
IPA510	$18,995.00
Opt. 02	$1,600.00
Opt. 03	$950.00
Opt. 04	$950.00
Opt. 1C	$1,200.00
Opt. 1E	$1,245.00
Opt. 1F	$4,000.00
Opt. 1G	$615.00
Opt. 1M	$1,000.00
Opt. 1R	$250.00
Opt. 1U	$8,000.00
Opt. 26	$25,000.00
Opt. 27	$5,250.00
Opt. 28	$10,000.00
Opt. 29	$1,650.00
Opt. 2E	$3,500.00
Opt. 2F	$4,800.00
Opt. 2S	$8,000.00
Opt. 2U	$8,000.00
Opt. 30	$1,950.00
Opt. 31	$1,950.00
Opt. 32	$1,950.00
Opt. 33	$1,950.00
Opt. 34	$1,950.00
Opt. 35	$4,200.00
Opt. 36	$600.00
Opt. 3F	$23,000.00
Opt. 3S	$10,000.00
Opt. 4F	$5,200.00
Opt. 4S	$12,000.00
Opt. 5S	$42,500.00
Opt. 6S	$13,000.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
IQSIMK	$950.00
J17	$1,095.00
J18	$1,995.00
J1803	$595.00
J1805	$595.00
J1806	$595.00
J1810	$1,495.00
J1811	$695.00
J1812	$795.00
J1820	$1,495.00
JUG201AU	$35.00
K212	$435.00
Opt. 10	$80.00
Opt. 12	$100.00
Opt. 22	$165.00
K415	$775.00
K420	$775.00
K465	$875.00
K475	$975.00
KNW242	$4,600.00
KNW403D	$2,800.00
KNW407	$2,700.00
KT10	$6,200.00
KT20	$6,200.00
LABROWS	$100.00
LABROWS01	$2,475.00
LABROWS05	$7,625.00
LABROWS08	$25,650.00
LABROWS11	$1,450.00
LABROWS15	$4,550.00
LABROWS18	$15,400.00
LABROWS41	$600.00
LABROWS45	$1,500.00
LABROWS48	$5,000.00
LACART	$875.00
LADM932	$6,000.00
Opt. 01	$1,200.00
Opt. 02	$2,450.00
Opt. 03	$2,450.00
Opt. 05	$2,450.00
Opt. 1D	–$1,500.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A5	$0.00
LADM933	$3,500.00
Opt. 1D	–$1,500.00
LADM934	$3,500.00
Opt. 1D	–$2,200.00
LADM935	$3,500.00
Opt. 1D	$0.00
LAF01	$6,800.00
LAF02	$11,000.00
LAF03	$15,250.00
LAF04	$6,800.00
LAF05	$11,000.00
LAF06	$6,800.00
LAFM932	$250.00
LAFM933	$250.00
LAFM934	$250.00
LAFM935	$250.00
LAHDP2	$1,250.00
Opt. 01	$775.00
Opt. 02	$260.00
LALINK	$10.00
LAOFFLN	$100.00
Opt. 01	$2,475.00
Opt. 05	$7,625.00
Opt. 08	$25,650.00
Opt. 11	$1,450.00
Opt. 15	$4,550.00
Opt. 18	$15,400.00
Opt. 41	$600.00
Opt. 45	$1,500.00
Opt. 48	$5,000.00
LAPIKB	$295.00
LAPIKPV	$295.00
LVWIN	$1,995.00
Opt. 10	$0.00
Opt. 21	$415.00
Opt. 95	$1,995.00
LVWIN9510	$0.00
LVWIN9511	$0.00
LVWIN9521	$415.00
LVWINAB	$1,044.00
LVWINNT	$1,995.00
Opt. 10	$0.00
Opt. 21	$415.00
LVWINTE	$520.00
LWCVI	$1,995.00
Opt. 10	$0.00
Opt. 21	$415.00
Opt. 95	$1,995.00
LWCVI9510	$0.00
LWCVI9511	$0.00
LWCVI9521	$415.00
LWCVIN	$1,995.00
Opt. 10	$0.00
Opt. 21	$415.00
LWCVITE	$520.00
LWDOS	$1,495.00
Opt. 10	$0.00
Opt. RT	$205.00
MB100	$53,100.00
Opt. 10	$4,500.00
Opt. 11	$12,400.00
Opt. 20	$13,400.00
Opt. 21	$17,000.00
Opt. 22	$14,500.00
Opt. 2M	$400.00
Opt. 30	$25,200.00
Opt. 31	$16,600.00
MB100R	$28,100.00
Opt. 10	$2,000.00
Opt. 11	$6,700.00
Opt. 1M	$200.00
Opt. 20	$7,300.00
Opt. 21	$9,200.00
Opt. 22	$7,950.00
Opt. 30	$13,850.00
Opt. 31	$9,000.00
MB100RT	$100.00
Opt. 11	$6,700.00
Opt. 22	$7,950.00
Opt. 31	$9,000.00
MB100T	$27,600.00
Opt. 10	$2,000.00
Opt. 11	$6,700.00
Opt. 1M	$200.00
Opt. 20	$7,300.00
Opt. 21	$9,200.00
Opt. 22	$7,950.00
Opt. 30	$13,850.00
Opt. 31	$9,000.00
Opt. T	$100.00
Opt. T11	$6,700.00
Opt. T22	$7,950.00
Opt. T31	$9,000.00
MC61	$60.00
MCTAP	$95.00
MDS21	$3,950.00
MDS22	$3,995.00
MI09	$170.00
MM18	$900.00

**1 Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

MP612A $200.00
MP613A50 ..... $300.00
MP613A75 ..... $300.00
MSDC203 ..... $8,350.00
MSDC204 ..... $8,721.00
MSS170A $11,325.00
MTD200 ..... $16,800.00
MTG200 ..... $15,500.00
MTS100 ..... $45,000.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
MXI2CBL $10.00
Opt. 01 ..... $35.00
Opt. 02 ..... $210.00
Opt. 04 ..... $245.00
Opt. 12 ..... $350.00
Opt. 14 ..... $380.00
MXI2PCI $4,500.00
Opt. 01 ..... $105.00
Opt. 02 ..... $315.00
Opt. 03 ..... $0.00
Opt. 04 ..... $200.00
MXI2VXI $2,395.00
Opt. 01 ..... $315.00
MXICBLS $10.00
Opt. 10 ..... $330.00
Opt. 11 ..... $350.00
Opt. 12 ..... $385.00
Opt. 20 ..... $350.00
Opt. 21 ..... $385.00
Opt. 30 ..... $335.00
Opt. 31 ..... $355.00
Opt. 41 ..... $65.00
MXIEXT $1,995.00
Opt. 10 ..... $400.00
MXIWIN $3,635.00
Opt. 10 ..... $400.00
NAP-B4 ..... $910.00
NAP-Z42 ..... $2,795.00
NAP02 ..... $2,465.00
Opt. 95 ..... $200.00
NAP04 ..... $3,200.00
Opt. 95 ..... $200.00
NAPZ2 ..... $375.00
NAPZ3 ..... $1,585.00
Opt. 95 ..... $95.00
NAPZ4 ..... $1,975.00
Opt. 95 ..... $95.00
NAPZ42 ..... $2,475.00
Opt. 95 ..... $95.00
NAPZ5 ..... $1,975.00
Opt. 95 ..... $95.00
NAPZ6 ..... $1,975.00
Opt. 95 ..... $95.00
NAPZ7 ..... $2,595.00
Opt. 95 ..... $95.00
NAPZ8 ..... $2,595.00
Opt. 95 ..... $95.00
NAPZ9 ..... $1,975.00
Opt. 95 ..... $95.00
NAS $1,175.00
Opt. Z7 ..... $1,325.00
Opt. Z1 ..... $950.00
Opt. Z10 ..... $165.00
Opt. Z2 ..... $1,150.00
Opt. Z3 ..... $950.00
Opt. Z5 ..... $915.00
Opt. Z6 ..... $1,250.00
Opt. Z9 ..... $65.00
NAZ10 ..... $150.00
NAZ30 ..... $350.00
NRV-Z53 ..... $1,450.00
NRV-Z54 ..... $2,325.00
NRVD $5,295.00
Opt. 01 ..... $655.00
Opt. 1R $340.00
Opt. 95 ..... $200.00
NRVS $2,695.00
Opt. 1R $340.00
Opt. 95 ..... $200.00
NRVZ102 ..... $1,265.00
Opt. 95 ..... $95.00
NRVZ103 ..... $1,380.00
Opt. 95 ..... $95.00
NRVZ202 ..... $1,685.00
Opt. 95 ..... $95.00
NRVZ203 ..... $1,825.00
Opt. 95 ..... $95.00
NRVZ302 ..... $1,250.00
Opt. 95 ..... $95.00
NRVZ303 ..... $1,250.00
NRVZ312 ..... $1,795.00
Opt. 95 ..... $95.00
NRVZ313 ..... $1,795.00
Opt. 95 ..... $95.00
NRVZ314 ..... $1,795.00
NRVZ402 ..... $1,055.00
Opt. 95 ..... $95.00
NRVZ403 ..... $1,195.00
Opt. 95 ..... $95.00
NRVZ502 ..... $1,725.00
Opt. 95 ..... $95.00
NRVZ503 ..... $1,940.00
Opt. 95 ..... $95.00
NRVZ51 ..... $885.00
Opt. 95 ..... $95.00
NRVZ52 ..... $1,325.00
Opt. 95 ..... $95.00
NRVZ6 ..... $1,650.00
Opt. 95 ..... $95.00
NRVZ8 ..... $1,275.00
Opt. 95 ..... $95.00
OA5002 ..... $7,395.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
OA5012 ..... $7,135.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
OA5022 ..... $7,135.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
OA5032 ..... $7,135.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
OCP5502 ..... $9,995.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
ORS2488 ..... $17,950.00
Opt. 1P ..... –$495.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
ORS622 ..... $11,495.00
Opt. 1P ..... –$495.00
Opt. 31 ..... $1,500.00
Opt. 41 ..... $1,600.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
P3410 ..... $1,250.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
P3420 ..... $3,450.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
P5100 ..... $199.00
P5102 ..... $199.00
P5200 ..... $425.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. A6 ..... $0.00
P5205 ..... $895.00
Opt. 96 ..... $50.00
P5210 ..... $1,895.00
Opt. 95 ..... $150.00
P6009 ..... $500.00
P6015A $1,050.00
Opt. 1R $65.00
Opt. 25 ..... $150.00
Opt. 2R $195.00
P6021 ..... $630.00
Opt. 03 ..... $60.00
P6022 ..... $675.00
Opt. 03 ..... $60.00
P6041 ..... $120.00
P6101B $65.00
P6103B $75.00
P6105A $200.00
Opt. 01 ..... $50.00
Opt. 03 ..... $55.00
P6106A $235.00
Opt. 01 ..... $40.00
Opt. 03 ..... $45.00
P6109B $90.00
P6111B $150.00
P6112 ..... $75.00
P6114B $185.00
P6117 ..... $100.00
P6119B $105.00
P6122 ..... $140.00
P6129B $135.00
P6131 ..... $220.00
Opt. 02 ..... $45.00
Opt. 03 ..... $50.00
P6133 ..... $195.00
Opt. 01 ..... $45.00
Opt. 03 ..... $50.00
Opt. 25 ..... $40.00
P6134C $275.00
P6135A $895.00
P6136 ..... $230.00
Opt. 25 ..... $40.00
P6137 ..... $250.00
P6138A $225.00
P6139A $295.00
P6150 ..... $1,150.00
P6156 ..... $305.00
Opt. 25 ..... $85.00
P6201 ..... $1,895.00
P6202A $1,295.00
P6204 ..... $1,795.00
Opt. 96 ..... $50.00
P6205 ..... $660.00
Opt. 96 ..... $50.00
P6207 ..... $3,995.00
P6217 ..... $3,995.00
P6240 ..... $195.00
P6243 ..... $395.00
Opt. 96 ..... $50.00
P6243S $1,295.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
P6245 ..... $1,395.00
P6246 ..... $2,495.00
Opt. 95 ..... $150.00
P6247 ..... $3,995.00
Opt. 95 ..... $150.00
P6408 ..... $615.00
P6417 ..... $500.00
P6434 ..... $995.00
Opt. 01 ..... $300.00
P6444 ..... $725.00
P6460 ..... $1,000.00
P6463A $1,100.00
Opt. 40 ..... $0.00
P6465 ..... $3,200.00
P6467 ..... $5,200.00
P6468 ..... $2,100.00
P6561A $230.00
P6562A $260.00
P6563A $290.00
P6701A $2,695.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
Opt. 04 ..... $0.00
Opt. 05 ..... $0.00
Opt. 96 ..... $50.00
P6701B $3,295.00
Opt. 95 ..... $150.00
Opt. FR $350.00
P6703A $3,695.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
Opt. 04 ..... $0.00
Opt. 05 ..... $0.00
Opt. 96 ..... $50.00
P6703B $3,695.00
Opt. 95 ..... $150.00
Opt. FR $350.00
P6711 ..... $2,195.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
Opt. 04 ..... $0.00
Opt. 05 ..... $0.00
P6713 ..... $2,595.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
Opt. 04 ..... $0.00
Opt. 05 ..... $0.00
P6723 ..... $2,495.00
Opt. 95 ..... $150.00
P6751 ..... $495.00
P850 ..... $150.00
PB200 ..... $34,500.00
Opt. 1M $200.00
Opt. 4S $1,000.00
Opt. 95 ..... $650.00
PPM203B $1,395.00
PS2520G $1,395.00
PS2521G $1,395.00
PS280 ..... $725.00
Opt. 96 ..... $50.00
PSAZ1 ..... $1,265.00

**1 Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Q32605 ..... $13,210.00
Q81201 ..... $1,210.00
Opt. 95 ..... $150.00
Q81202 ..... $1,980.00
Q81203 ..... $3,080.00
Q81204 ..... $2,860.00
Q81205 ..... $3,855.00
Q81206 ..... $5,505.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Q81207 ..... $6,055.00
Q81211 ..... $5,505.00
Q81212 ..... $8,255.00
Q8134 ..... $1,920.00
Q81345 ..... $3,750.00
Q82018A $1,760.00
Opt. 95 ..... $150.00
Q82039 ..... $4,405.00
Q82202 ..... $1,100.00
Q82208 ..... $5,285.00
Opt. 96 ..... $50.00
Q8221 ..... $2,195.00
Opt. 1R $318.00
Q82214 ..... $895.00
Opt. 96 ..... $50.00
Q82215 ..... $1,350.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Q82216 ..... $3,850.00
Q8344A $36,995.00
Opt. 01 ..... $2,200.00
Opt. 10 ..... $1,100.00
Opt. 1R $596.00
Q8347 ..... $83,995.00
Opt. 1R $311.00
Q8381A $35,995.00
Opt. 1R $596.00
Q8383 ..... $43,900.00
Q84601 ..... $18,950.00
Q84605 ..... $11,560.00
Q84605P $11,560.00
Q84606 ..... $16,515.00
Q8460A $8,805.00
Opt. 80 ..... $1,100.00
Q84621A $23,500.00
R14601 ..... $1,150.00
R16056A $1,100.00
R16059 ..... $1,100.00
R16072 ..... $1,320.00
R16074 ..... $765.00
R16211 ..... $530.00
R16216 ..... $495.00
R16219 ..... $685.00
R16601 ..... $85.00
R16905 ..... $430.00
R2465A $57,000.00
R2465B $66,500.00
Opt. 1R $353.00
R2471A $63,000.00
R2471B $76,750.00
R3261C $13,950.00
Opt. 12 ..... $1,095.00
Opt. 15 ..... $2,195.00
Opt. 1K $2,000.00
Opt. 1R $353.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3261CN $13,950.00
Opt. 12 ..... $1,095.00
Opt. 15 ..... $2,195.00
R3261D $19,865.00
Opt. 12 ..... $1,095.00
Opt. 15 ..... $2,195.00
Opt. 1K $2,000.00
Opt. 95 ..... $150.00
R3263 ..... $21,950.00
Opt. 01 ..... $6,000.00
Opt. 03 ..... $2,000.00
Opt. 15 ..... $750.00
Opt. 1R $330.00
R3265A $32,250.00
Opt. 07 ..... $750.00
Opt. 1R $353.00
Opt. 21 ..... $660.00
Opt. 96 ..... $50.00
R3271A $31,995.00
Opt. 06 ..... $3,340.00
Opt. 07 ..... $750.00
Opt. 1R $353.00
Opt. 21 ..... $660.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3272 ..... $25,495.00
Opt. 15 ..... $750.00
Opt. 1R $219.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3361C $19,980.00
Opt. 12 ..... $1,095.00
Opt. 15 ..... $2,195.00
Opt. 1K $2,000.00
Opt. 1R $353.00
Opt. 96 ..... $50.00
R3361CN $19,980.00
Opt. 12 ..... $1,095.00
Opt. 15 ..... $2,195.00
Opt. 1R $353.00
R3361D $25,795.00
Opt. 12 ..... $1,095.00
Opt. 15 ..... $2,195.00
Opt. 1K $2,000.00
Opt. 1R $353.00
Opt. 96 ..... $50.00
R3365A $43,750.00
Opt. 07 ..... $750.00
Opt. 1R $353.00
Opt. 21 ..... $660.00
Opt. 96 ..... $50.00
R3371A $51,500.00
Opt. 07 ..... $750.00
Opt. 1R $353.00
Opt. 21 ..... $660.00
R3463 ..... $27,500.00
Opt. 02 ..... $2,150.00
Opt. 03 ..... $2,000.00
Opt. 04 ..... $5,000.00
Opt. 09 ..... $1,950.00
Opt. 15 ..... $750.00
Opt. 1R $330.00
Opt. 95 ..... $150.00
R3465 ..... $32,995.00
Opt. 01 ..... $6,000.00
Opt. 02 ..... $2,150.00
Opt. 03 ..... $2,000.00
Opt. 04 ..... $5,000.00
Opt. 05 ..... $2,000.00
Opt. 08 ..... $2,125.00
Opt. 09 ..... $1,950.00
Opt. 15 ..... $750.00
Opt. 1R $330.00
Opt. 61 ..... $8,500.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3465GS $32,995.00
Opt. 02 ..... $2,150.00
Opt. 05 ..... $2,000.00
Opt. 15 ..... $750.00
Opt. 1R $330.00
R3541C $27,500.00
R3551 ..... $20,500.00
Opt. 95 ..... $150.00
R3561L $10,925.00
R3753AH $26,300.00
Opt. 1R $155.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3753B $24,300.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3765AH $22,500.00
Opt. 1R $225.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3765BH $23,500.00
Opt. 1R $225.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3765CH $34,000.00
Opt. 1R $225.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3767AH $29,000.00
Opt. 1R $225.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3767BH $30,500.00
Opt. 1R $225.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3767CH $39,750.00
Opt. 1R $225.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3961B $11,560.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3961BN $11,560.00
R3962A $12,000.00
Opt. 1R $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3963A $16,000.00
Opt. 1R $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R3964A $4,500.00
Opt. 1R $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R4131D $9,995.00
Opt. 14 ..... $1,300.00
Opt. 1R $300.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
R49512B $1,500.00
R49513B $1,500.00
R5361B $3,700.00
Opt. 95 ..... $150.00
R74201A $5,000.00
Opt. 95 ..... $150.00
R9211A $15,300.00
Opt. 07 ..... $2,200.00
Opt. 10 ..... $2,750.00
Opt. 11 ..... $2,200.00
Opt. 12 ..... $2,750.00
Opt. 95 ..... $150.00
R9211B $17,700.00
Opt. 07 ..... $2,200.00
Opt. 10 ..... $2,750.00
Opt. 11 ..... $2,200.00
R9211C $23,800.00
Opt. 07 ..... $2,200.00
Opt. 10 ..... $2,750.00
Opt. 96 ..... $50.00
R9211E $12,900.00
Opt. 06 ..... $1,100.00
Opt. 07 ..... $2,200.00
Opt. 10 ..... $2,750.00
RAD $225.00
RAD50 ..... $200.00
RAD600 ..... $200.00
RAM $650.00
RAU $1,300.00
RAZ $595.00
RBS1000 ..... $5,025.00
RBU37 ..... $4,250.00
RC210 ..... $1,250.00
Opt. A6 ..... $0.00
RC211 ..... $1,250.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A6 ..... $0.00
REP4100 ..... $30.00
REP4200 ..... $50.00
REP4300 ..... $80.00
REP4400 ..... $130.00
REP4500 ..... $200.00
REP4600 ..... $295.00
REP4700 ..... $565.00
REP4800 ..... $1,065.00
REP5100 ..... $150.00
REP5200 ..... $170.00
REP5300 ..... $200.00
REP5400 ..... $250.00
REP5500 ..... $320.00
REP5600 ..... $415.00
REP5700 ..... $685.00
REP5800 ..... $1,185.00
RFM150 ..... $2,250.00
Opt. 01 ..... $160.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
RFM90 ..... $995.00
Opt. 01 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A6 ..... $0.00
RNB $125.00
RSG $8,250.00
Opt. 95 ..... $310.00
RSM $10,950.00
Opt. 95 ..... $310.00
RSP $14,300.00
Opt. 95 ..... $310.00
RVZ $990.00
S26EM12 ..... $1,950.00
S26UT10 ..... $725.00
S3FG210 ..... $395.00
S3FG220 ..... $495.00
S3FG510 ..... $450.00
S3FT100 ..... $595.00
S3FT110 ..... $795.00
S3FT200 ..... $495.00
S3FT300 ..... $495.00
S3FT400 ..... $895.00
S85HFS1 ..... $1,025.00
SA42 ..... $3,995.00
Opt. 1E ..... –$500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
SA46 ..... $7,195.00
Opt. 1E ..... –$500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00

**1 Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. A5 ..... $0.00
SAF $22,410.00
Opt. 95 ..... $373.00
Opt. Z1 ..... $3,450.00
SAF-Z $853.00
SAFZ1 ..... $3,450.00
SC100A $4,100.00
SCS9000 ..... $1.00
SD14 ..... $4,950.00
Opt. 01 ..... $250.00
Opt. 95 ..... $150.00
SD20 ..... $4,400.00
Opt. 95 ..... $150.00
SD22 ..... $3,780.00
Opt. 95 ..... $150.00
SD24 ..... $6,950.00
Opt. 95 ..... $150.00
SD26 ..... $3,780.00
Opt. 95 ..... $150.00
SD32 ..... $5,950.00
Opt. 95 ..... $150.00
SD42 ..... $3,995.00
SD46 ..... $7,195.00
SD51 ..... $4,500.00
SDA601 ..... $2,995.00
Opt. 01 ..... $60.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A6 ..... $0.00
SF201 ..... $50.00
SF202 ..... $50.00
SF203 ..... $50.00
SF501 ..... $50.00
SF502 ..... $50.00
SF503 ..... $50.00
SFF $17,920.00
Opt. 95 ..... $344.00
SFZ $39,340.00
Opt. AT $6,150.00
Opt. BS $630.00
Opt. CC $2,250.00
Opt. D2 ..... $2,820.00
Opt. FM $2,190.00
Opt. IF $7,620.00
Opt. NG $8,790.00
Opt. NT $2,250.00
SGMF02 ..... $7,980.00
SGMF34 ..... $8,990.00
SGPF $7,980.00
SGSF $10,690.00
SIU800 ..... $1,950.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. A6 ..... $0.00
SJ300E $29,600.00
Opt. 03 ..... $4,125.00
Opt. 04 ..... $6,125.00
Opt. 06 ..... $8,250.00
Opt. 09 ..... $3,500.00
Opt. 1M $200.00
Opt. 3C $0.00
Opt. 4C $0.00
Opt. 4S $2,250.00
Opt. 7C $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
SJ30F03 ..... $7,995.00
SJ30F04 ..... $7,995.00
SJ30F06 ..... $10,500.00
SJ30F07 ..... $750.00
SJ30FA6 ..... $5,250.00
SJ30FE4 ..... $11,995.00
SJ30U08 ..... $8,000.00
SJ30U12 ..... $2,000.00
SM-B1 ..... $1,150.00
SM-B2 ..... $995.00
SM-B3 ..... $2,525.00
SM-B4 ..... $1,195.00
SM-B5 ..... $1,950.00
SM-B6 ..... $2,695.00
SM-B8 ..... $2,600.00
SM-B9 ..... $3,790.00
SM11 ..... $29,500.00
Opt. 1R $275.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
SMCK1 ..... $115.00
SME-B11 ..... $1,550.00
SME-B12 ..... $1,085.00
SME-B41 ..... $1,600.00
SME-B42 ..... $1,395.00
SME-K2 ..... $0.00
SME02 ..... $17,350.00
Opt. 01 ..... $1,150.00
Opt. 02 ..... $995.00
Opt. 03 ..... $2,525.00
Opt. 04 ..... $1,195.00
Opt. 05 ..... $1,950.00
Opt. 06 ..... $2,695.00
Opt. 11 ..... $1,550.00
Opt. 12 ..... $1,085.00
Opt. 19 ..... $260.00
Opt. 1R $195.00
Opt. 41 ..... $1,600.00
Opt. 42 ..... $1,450.00
Opt. 95 ..... $225.00
SME03 ..... $21,750.00
Opt. 01 ..... $1,150.00
Opt. 02 ..... $995.00
Opt. 04 ..... $1,195.00
Opt. 05 ..... $1,950.00
Opt. 06 ..... $2,695.00
Opt. 08 ..... $2,600.00
Opt. 11 ..... $1,550.00
Opt. 12 ..... $1,085.00
Opt. 19 ..... $260.00
Opt. 1R $195.00
Opt. 41 ..... $1,600.00
Opt. 42 ..... $1,450.00
Opt. 95 ..... $225.00
SME03E $19,400.00
Opt. 01 ..... $1,150.00
Opt. 02 ..... $995.00
Opt. 04 ..... $1,150.00
Opt. 05 ..... $1,950.00
Opt. 06 ..... $2,695.00
Opt. 08 ..... $2,600.00
Opt. 12 ..... $1,085.00
Opt. 19 ..... $260.00
Opt. 1R $195.00
Opt. 41 ..... $1,600.00
Opt. 42 ..... $1,450.00
Opt. 95 ..... $225.00
SME06 ..... $34,450.00
Opt. 01 ..... $1,150.00
Opt. 02 ..... $995.00
Opt. 04 ..... $1,150.00
Opt. 05 ..... $1,950.00
Opt. 06 ..... $2,695.00
Opt. 09 ..... $3,790.00
Opt. 11 ..... $1,550.00
Opt. 12 ..... $1,085.00
Opt. 19 ..... $260.00
Opt. 1R $195.00
Opt. 41 ..... $1,600.00
Opt. 42 ..... $1,450.00
Opt. 95 ..... $225.00
SMG $15,555.00
Opt. 01 ..... $1,800.30
Opt. 02 ..... $1,595.00
Opt. 03 ..... $665.00
Opt. 10 ..... $335.00
Opt. 1R $195.00
Opt. 95 ..... $205.00
Opt. B1 ..... $1,745.00
SMG43 ..... $19,945.00
SMG50 ..... $99.00
SMGL $22,350.00
Opt. 01 ..... $1,800.30
Opt. 02 ..... $1,695.00
Opt. 03 ..... $665.00
Opt. 10 ..... $335.00
Opt. 95 ..... $200.00
Opt. Z10 ..... $335.00
SMGU $34,250.00
Opt. 10 ..... $335.00
Opt. 1R $195.00
Opt. 95 ..... $205.00
Opt. B9 ..... $260.10
SMGUZ2 ..... $2,395.00
SMGZ2 ..... $950.00
SMH $20,350.00
Opt. 01 ..... $1,600.00
Opt. 02 ..... $1,509.60
Opt. 03 ..... $585.00
Opt. 10 ..... $285.00
Opt. 1R $195.00
Opt. 95 ..... $225.00
SMHU *1
Opt. B2 ..... $2,800.00
Opt. B3 ..... $2,800.00
Opt. B4 ..... $2,800.00
Opt. B5 ..... $3,520.00
Opt. B6 ..... $6,910.00
Opt. B7 ..... $3,675.00
SMHU52 ..... $40,950.00
Opt. 10 ..... $325.00
Opt. 95 ..... $225.00
SMHU58 ..... $46,850.00
Opt. 01 ..... $2,925.00
Opt. 02 ..... $2,925.00
Opt. 03 ..... $2,925.00
Opt. 04 ..... $3,675.00
Opt. 06 ..... $6,975.00
Opt. 07 ..... $3,675.00
Opt. 10 ..... $275.00
Opt. 95 ..... $225.00
SMIQ02 ..... $27,950.00
Opt. 1R $185.00
Opt. 95 ..... $228.00
Opt. B1 ..... $1,095.00
Opt. B10 ..... $4,150.00
Opt. B11 ..... $1,350.00
Opt. B12 ..... $700.00
Opt. B13 ..... $700.00
Opt. B14 ..... $11,500.00
Opt. B15 ..... $11,500.00
Opt. B19 ..... $200.00
Opt. B42 ..... $1,550.00
Opt. B5 ..... $1,875.00
SMIQ02E $16,000.00
Opt. 1R $185.00
Opt. 95 ..... $228.00
Opt. B1 ..... $1,095.00
Opt. B10 ..... $4,150.00
Opt. B11 ..... $1,350.00
Opt. B12 ..... $700.00
Opt. B13 ..... $700.00
Opt. B14 ..... $11,500.00
Opt. B15 ..... $11,500.00
Opt. B19 ..... $200.00
Opt. B42 ..... $1,550.00
Opt. B5 ..... $1,875.00
SMIQ03 ..... $30,950.00
Opt. 1R $185.00
Opt. 95 ..... $228.00
Opt. B1 ..... $1,095.00
Opt. B10 ..... $4,150.00
Opt. B11 ..... $1,350.00
Opt. B12 ..... $700.00
Opt. B13 ..... $700.00
Opt. B14 ..... $11,500.00
Opt. B15 ..... $11,500.00
Opt. B19 ..... $200.00
Opt. B42 ..... $1,550.00
Opt. B5 ..... $1,875.00
SMIQ03E $17,500.00
Opt. 1R $185.00
Opt. 95 ..... $228.00
Opt. B1 ..... $1,095.00
Opt. B10 ..... $4,150.00
Opt. B11 ..... $1,350.00
Opt. B12 ..... $700.00
Opt. B13 ..... $700.00
Opt. B14 ..... $11,500.00
Opt. B15 ..... $11,500.00
Opt. B19 ..... $200.00
Opt. B42 ..... $1,550.00
Opt. B5 ..... $1,875.00
SMK4 ..... $80.00
SMP02 ..... $33,500.00
Opt. 01 ..... $1,225.00
Opt. 02 ..... $1,050.00
Opt. 05 ..... $2,095.00
Opt. 11 ..... $4,325.00
Opt. 12 ..... $4,030.00
Opt. 13 ..... $1,275.00
Opt. 14 ..... $975.00
Opt. 15 ..... $3,075.00
Opt. 18 ..... $690.00
Opt. 19 ..... $1,125.00
Opt. 95 ..... $325.00
SMP03 ..... $41,950.00
Opt. 01 ..... $1,225.00
Opt. 02 ..... $1,050.00
Opt. 05 ..... $2,095.00
Opt. 11 ..... $4,325.00
Opt. 12 ..... $4,030.00
Opt. 13 ..... $1,275.00
Opt. 14 ..... $975.00
Opt. 15 ..... $3,075.00
Opt. 18 ..... $690.00
Opt. 19 ..... $1,275.00
Opt. 95 ..... $325.00
SMP04 ..... $48,900.00
Opt. 01 ..... $1,225.00
Opt. 02 ..... $1,050.00
Opt. 05 ..... $2,095.00
Opt. 11 ..... $4,325.00
Opt. 12 ..... $4,030.00
Opt. 13 ..... $1,275.00
Opt. 14 ..... $975.00
Opt. 15 ..... $3,075.00
Opt. 18 ..... $690.00
Opt. 19 ..... $1,275.00
Opt. 95 ..... $325.00
SMP22 ..... $44,375.00
Opt. 01 ..... $1,225.00
Opt. 02 ..... $1,050.00
Opt. 05 ..... $2,095.00
Opt. 11 ..... $4,325.00
Opt. 12 ..... $4,030.00
Opt. 13 ..... $1,275.00
Opt. 14 ..... $975.00

*1 *Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 15 ..... $3,075.00
Opt. 18 ..... $690.00
Opt. 19 ..... $1,275.00
Opt. 95 ..... $325.00
SMQK1 ..... $300.00
SMT02 ..... $10,600.00
Opt. 01 ..... $1,095.00
Opt. 02 ..... $950.00
Opt. 03 ..... $2,375.00
Opt. 04 ..... $1,150.00
Opt. 06 ..... $2,575.00
Opt. 1R $185.00
Opt. 20 ..... $225.00
Opt. 95 ..... $200.00
SMT03 ..... $13,300.00
Opt. 01 ..... $1,095.00
Opt. 02 ..... $950.00
Opt. 04 ..... $1,150.00
Opt. 06 ..... $2,575.00
Opt. 08 ..... $2,500.00
Opt. 1R $185.00
Opt. 20 ..... $225.00
Opt. 95 ..... $200.00
SMT06 ..... $22,450.00
Opt. 01 ..... $1,095.00
Opt. 02 ..... $950.00
Opt. 04 ..... $1,150.00
Opt. 06 ..... $2,575.00
Opt. 09 ..... $3,725.00
Opt. 1R $185.00
Opt. 20 ..... $225.00
Opt. 95 ..... $200.00
SMX $9,150.00
Opt. 01 ..... $1,425.00
Opt. 02 ..... $1,425.00
Opt. 10 ..... $350.00
Opt. 11 ..... $625.00
Opt. 1R $180.00
Opt. 95 ..... $158.00
Opt. Z2 ..... $545.00
SMY-B10 ..... $240.00
SMY01 ..... $6,750.00
Opt. 01 ..... $940.00
Opt. 10 ..... $244.00
Opt. 1R $180.00
Opt. 95 ..... $200.00
SMY02 ..... $7,900.00
Opt. 01 ..... $940.00
Opt. 10 ..... $244.00
Opt. 1R $180.00
Opt. 95 ..... $200.00
SMZ2 ..... $1,175.00
SP232 ..... $625.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
SPG1000 ..... $6,900.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
Opt. 04 ..... $0.00
Opt. 15 ..... $0.00
Opt. 16 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
SPG170A $3,550.00
Opt. 01 ..... $1,000.00
Opt. 1J $0.00
Opt. 2J $1,000.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
SPG271 ..... $3,225.00
Opt. 01 ..... $635.00
Opt. 02 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
SPG422 ..... $4,200.00
Opt. 01 ..... $1,075.00
Opt. 02 ..... $975.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
ST103A $38,800.00
Opt. 04 ..... $17,400.00
Opt. 2M $400.00
Opt. 3C $0.00
Opt. 4C $0.00
ST103AR $21,000.00
ST103AR04 ..... $9,400.00
ST103AR1M $200.00
ST103AR3C $0.00
ST103AR4C $0.00
ST103AT $21,000.00
Opt. 04 ..... $9,400.00
Opt. 1M $200.00
Opt. 3C $0.00
Opt. 4C $0.00
ST10F4R $9,200.00
ST10F4T $9,200.00
ST10FPS $3,600.00
ST10FR3 ..... $0.00
ST10FR4 ..... $0.00
ST112 ..... $19,900.00
Opt. 03 ..... $7,000.00
Opt. 04 ..... $15,600.00
Opt. 06 ..... $500.00
Opt. 07 ..... $2,500.00
Opt. 08 ..... $5,000.00
Opt. 1C $0.00
Opt. 1M $200.00
Opt. 2C $0.00
Opt. 3C $0.00
Opt. 4C $0.00
Opt. 5R $5,000.00
ST11F03 ..... $7,500.00
ST11F04 ..... $11,500.00
ST11F08 ..... $8,000.00
ST11F5R $8,000.00
ST11FE4 ..... $15,500.00
ST11FR3 ..... $0.00
ST11FR4 ..... $0.00
ST2400 ..... $100.00
Opt. 11 ..... $34,800.00
Opt. 12 ..... $37,400.00
Opt. 13 ..... $59,400.00
Opt. 14 ..... $42,400.00
Opt. 15 ..... $64,400.00
Opt. 16 ..... $50,800.00
Opt. 17 ..... $74,400.00
Opt. 1A $250.00
Opt. 1M $200.00
Opt. 3C $0.00
Opt. 4C $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
STRM100 ..... $15,000.00
SWVF $34,205.00
SX4610 ..... $49,000.00
Opt. 02 ..... $4,100.00
Opt. 03 ..... $8,400.00
Opt. 04 ..... $16,900.00
Opt. 1C ..... –$3,000.00
Opt. 22 ..... $6,800.00
Opt. 36 ..... $8,800.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
TCP202 ..... $1,320.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
TD3F14A $525.00
TDS210 ..... $995.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L2 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
TDS220 ..... $1,695.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L2 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
TDS2CM $250.00
TDS2HM $150.00
TDS340A $3,195.00
Opt. 14 ..... $525.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
TDS360 ..... $3,695.00
Opt. 14 ..... $525.00
Opt. 95 ..... $150.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
TDS380 ..... $4,795.00
Opt. 14 ..... $525.00
Opt. 95 ..... $150.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
TDS420A $6,595.00
Opt. 05 ..... $995.00
Opt. 1K $435.00
Opt. 1R $350.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. B2 ..... $50.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. XL $995.00
TDS430A $5,495.00
Opt. 05 ..... $995.00
Opt. 1K $435.00
Opt. 1R $350.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. B2 ..... $50.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. XL $995.00
TDS460A $7,685.00
Opt. 05 ..... $995.00
Opt. 1K $435.00
Opt. 1R $350.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. B2 ..... $50.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. XL $995.00
TDS4F13 ..... $595.00
TDS4F2F $1,390.00
TDS4F5P $495.00
TDS510A $9,950.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1K $775.00
Opt. 1R $400.00
Opt. 20 ..... $1,320.00
Opt. 21 ..... $1,950.00
Opt. 2F $995.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. B2 ..... $50.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
TDS520B $8,950.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1K $775.00
Opt. 1M $1,495.00
Opt. 1R $400.00
Opt. 20 ..... $1,320.00
Opt. 21 ..... $1,950.00

**1 Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 22 ..... $590.00
Opt. 23 ..... $790.00
Opt. 28 ..... $995.00
Opt. 2D ..... –$570.00
Opt. 2F $995.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS520C $9,295.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1K $775.00
Opt. 1M $995.00
Opt. 1R $400.00
Opt. 22 ..... $590.00
Opt. 2C $3,250.00
Opt. 2D $0.00
Opt. 2F $995.00
Opt. 2M $2,995.00
Opt. 3C $3,800.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4C $4,200.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. HD $990.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS540B $15,150.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1G $0.00
Opt. 1K $775.00
Opt. 1M $2,495.00
Opt. 1R $400.00
Opt. 20 ..... $1,320.00
Opt. 21 ..... $1,950.00
Opt. 23 ..... $790.00
Opt. 28 ..... $995.00
Opt. 2F $995.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4D ..... –$1,140.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS540C $15,750.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1K $775.00
Opt. 1M $1,995.00
Opt. 1R $400.00
Opt. 23 ..... $1,580.00
Opt. 2C $3,250.00
Opt. 2F $995.00
Opt. 2M $4,995.00
Opt. 3C $3,800.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4C $4,200.00
Opt. 4D $0.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. HD $990.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS620B $7,950.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1K $775.00
Opt. 1R $400.00
Opt. 24 ..... $1,180.00
Opt. 2D ..... –$790.00
Opt. 2F $995.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS640A $9,950.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1K $775.00
Opt. 1R $400.00
Opt. 2F $995.00
Opt. 3P $1,450.00
Opt. 4D ..... –$1,140.00
Opt. 95 ..... $150.00

TDS644B $14,950.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1R $400.00
Opt. 24 ..... $1,180.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4D ..... –$1,580.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS680B $19,195.00
Opt. 05 ..... $1,495.00
Opt. 13 ..... $495.00
Opt. 1K $775.00
Opt. 1R $400.00
Opt. 24 ..... $1,180.00
Opt. 27 ..... $2,510.00
Opt. 2F $995.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS684B $29,995.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1R $400.00
Opt. 24 ..... $1,140.00
Opt. 26 ..... $5,020.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00

TDS68U1 ..... $825.00

TDS724A $12,200.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1M $1,495.00
Opt. 1R $400.00
Opt. 20 ..... $1,320.00
Opt. 21 ..... $1,950.00
Opt. 22 ..... $570.00
Opt. 23 ..... $790.00
Opt. 28 ..... $995.00
Opt. 2D ..... –$570.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00

TDS724C $12,695.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1M $995.00
Opt. 1R $400.00
Opt. 22 ..... $590.00
Opt. 2C $3,250.00
Opt. 2D $0.00
Opt. 2M $2,995.00
Opt. 3C $3,800.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4C $4,200.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. HD $990.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS754A $18,750.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1M $2,495.00
Opt. 1R $400.00
Opt. 20 ..... $1,320.00
Opt. 21 ..... $1,950.00
Opt. 23 ..... $790.00
Opt. 28 ..... $995.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4D ..... –$1,180.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS754C $19,500.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1M $1,995.00
Opt. 1R $400.00
Opt. 23 ..... $1,580.00
Opt. 2C $3,250.00
Opt. 2M $4,995.00
Opt. 3C $3,800.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4C $4,200.00
Opt. 4D $0.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. HD $990.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS782A $21,995.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1M $1,495.00
Opt. 1R $400.00
Opt. 20 ..... $1,320.00
Opt. 21 ..... $1,950.00
Opt. 24 ..... $1,180.00
Opt. 27 ..... $2,510.00
Opt. 28 ..... $995.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00

TDS784A $29,995.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1M $2,495.00
Opt. 1R $400.00
Opt. 20 ..... $1,320.00
Opt. 21 ..... $1,950.00
Opt. 24 ..... $1,180.00
Opt. 26 ..... $5,020.00
Opt. 28 ..... $995.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00
TDS784C $31,195.00
Opt. 05 ..... $1,495.00
Opt. 1K $775.00
Opt. 1M $1,995.00
Opt. 1R $400.00
Opt. 24 ..... $1,180.00
Opt. 26 ..... $5,580.00
Opt. 2C $3,250.00
Opt. 2M $4,995.00
Opt. 3C $3,800.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 4C $4,200.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. C3 ..... $565.00
Opt. HD $990.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L5 ..... $0.00
Opt. L9 ..... $0.00
TDS7U01 ..... $525.00
TDS820 ..... $20,990.00
Opt. 13 ..... $495.00
Opt. 1D ..... –$450.00
Opt. 1R $410.00
Opt. 2D ..... –$3,300.00
Opt. 2F $1,495.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. B1 ..... $150.00
TDSXF05 ..... $2,049.00
Opt. 1D ..... –$75.00
TDSXF13 ..... $619.00
Opt. 1D ..... –$75.00
TDSXF1F $619.00
TDSXF2F $1,349.00
Opt. 1D ..... –$75.00
TFC200 ..... $1,375.00
Opt. 0C $55.00
Opt. 1C $75.00
Opt. 20 ..... $0.00
Opt. 21 ..... $0.00
Opt. 22 ..... $0.00
Opt. 24 ..... $0.00
Opt. 25 ..... $0.00
Opt. 27 ..... $0.00
Opt. 28 ..... $0.00
Opt. 2C $75.00
Opt. 95 ..... $150.00
TFP2A $12,800.00
Opt. 01 ..... $8,500.00
Opt. 03 ..... $16,500.00
Opt. 04 ..... $16,500.00
Opt. 05 ..... $17,500.00
Opt. 06 ..... $23,000.00
Opt. 08 ..... $23,000.00
Opt. 09 ..... $17,750.00
Opt. 10 ..... $11,800.00
Opt. 11 ..... $14,000.00
Opt. 14 ..... $995.00
Opt. 16 ..... $1,800.00
Opt. 17 ..... $2,500.00
Opt. 19 ..... $250.00
Opt. 1R $400.00
Opt. 1S $500.00
Opt. 1T $895.00
Opt. 20 ..... $0.00
Opt. 21 ..... $0.00
Opt. 22 ..... $0.00
Opt. 23 ..... $0.00
Opt. 24 ..... $0.00
Opt. 25 ..... $0.00
Opt. 26 ..... $0.00
Opt. 27 ..... $0.00
Opt. 28 ..... $0.00
Opt. 29 ..... $0.00
Opt. 2T $850.00
Opt. 30 ..... $0.00
Opt. 31 ..... $0.00
Opt. 32 ..... $0.00
Opt. 33 ..... $0.00
Opt. 34 ..... $0.00
Opt. 35 ..... $0.00
Opt. 36 ..... $0.00
Opt. 37 ..... $0.00
Opt. 38 ..... $0.00
Opt. 39 ..... $0.00
Opt. 3T $1,005.00
Opt. 41 ..... $0.00
Opt. 42 ..... $0.00
Opt. 4T $1,400.00
Opt. 5T $695.00
Opt. 6T $1,195.00
Opt. 7T $2,895.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. L1 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
TFS3031 ..... $4,500.00
Opt. 01 ..... $4,400.00
Opt. 03 ..... $8,000.00
Opt. 04 ..... $5,000.00
Opt. 06 ..... $7,500.00
Opt. 10 ..... $11,000.00
Opt. 11 ..... $400.00
Opt. 19 ..... $125.00
Opt. 1S $500.00
Opt. 1T $260.00
Opt. 20 ..... $0.00
Opt. 21 ..... $0.00
Opt. 22 ..... $0.00
Opt. 24 ..... $0.00
Opt. 25 ..... $0.00
Opt. 26 ..... $0.00
Opt. 28 ..... $0.00
Opt. 2T $850.00
Opt. 30 ..... $0.00
Opt. 31 ..... $0.00
Opt. 32 ..... $0.00
Opt. 34 ..... $0.00
Opt. 35 ..... $0.00
Opt. 36 ..... $0.00
Opt. 38 ..... $0.00
Opt. 3T $1,005.00
Opt. 41 ..... $0.00
Opt. 42 ..... $0.00
Opt. 4T $1,400.00
Opt. 5T $695.00
Opt. 6T $1,195.00
Opt. 7T $2,895.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. A6 ..... $0.00
Opt. L1 ..... $0.00
Opt. L2 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. LF $0.00
TG2000 ..... $7,400.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
THM5AC $75.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
THM5BAT $60.00
THM5CHG $180.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A6 ..... $0.00
THM5HCA $100.00
THM5SCA $100.00
THS710A $1,995.00
Opt. 1B $228.00
Opt. 2B $228.00
Opt. 3B $228.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A6 ..... $0.00
Opt. L1 ..... $0.00
Opt. L2 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
THS720A $2,295.00
Opt. 1B $228.00
Opt. 2B $228.00
Opt. 3B $228.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A6 ..... $0.00
Opt. L0 ..... $0.00
Opt. L1 ..... $0.00
Opt. L2 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
THS720P $2,995.00
Opt. 1B $228.00
Opt. 2B $228.00
Opt. 3B $228.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A6 ..... $0.00
Opt. L1 ..... $0.00
Opt. L2 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
THS730A $3,195.00
Opt. 1B $228.00
Opt. 2B $228.00
Opt. 3B $228.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A6 ..... $0.00
Opt. L1 ..... $0.00
Opt. L2 ..... $0.00
Opt. L3 ..... $0.00
Opt. L4 ..... $0.00
Opt. L5 ..... $0.00
Opt. L6 ..... $0.00
Opt. L7 ..... $0.00
Opt. L8 ..... $0.00
Opt. L9 ..... $0.00
THS7BAT $60.00
THS7CHG $195.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A6 ..... $0.00
THS7HCA $160.00
TLA510 ..... $19,000.00
Opt. 01 ..... $4,300.00
Opt. 02 ..... $8,600.00
Opt. 03 ..... $13,550.00
Opt. 04 ..... $2,600.00
Opt. 06 ..... $23,700.00
Opt. 1P $625.00
Opt. 1X $0.00
Opt. 30 ..... $7,800.00
Opt. 4X $1,900.00
Opt. 5C $0.00
Opt. 8S $2,100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
TLA520 ..... $31,500.00
Opt. 01 ..... $8,600.00
Opt. 02 ..... $17,200.00
Opt. 03 ..... $27,100.00
Opt. 04 ..... $2,600.00
Opt. 06 ..... $47,400.00
Opt. 1D ..... –$3,600.00
Opt. 1P $1,250.00
Opt. 1X $0.00
Opt. 4X $1,900.00
Opt. 5C $0.00
Opt. 8S $4,200.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
TLA704 ..... $9,000.00
Opt. 1A $400.00
Opt. 1K $850.00
Opt. 1M $1,000.00
Opt. 1S $1,000.00
Opt. 2M $2,000.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. A5 ..... $0.00
TLA711 ..... $14,000.00
Opt. 1A $400.00
Opt. 1K $850.00
Opt. 1M $1,000.00
Opt. 1S $1,000.00
Opt. 2M $2,000.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
TLA7D1 ..... $10,000.00
Opt. 95 ..... $150.00
TLA7D2 ..... $17,000.00
Opt. 95 ..... $150.00
TLA7E1 ..... $18,000.00
Opt. 95 ..... $150.00
TLA7E2 ..... $28,000.00
Opt. 95 ..... $150.00
TLA7F1 ..... $2,000.00
TLA7F2 ..... $2,000.00
Opt. 1M $1,000.00
Opt. 1S $2,500.00
Opt. 2M $2,000.00
Opt. 2S $3,750.00
Opt. 3M $3,000.00
Opt. 3S $5,250.00
Opt. 4M $4,000.00
Opt. 4S $7,000.00
Opt. 5S $4,000.00
Opt. 6S $6,750.00
Opt. 7S $9,750.00
Opt. 8S $13,000.00
TLA7F3 ..... $500.00
TLA7L1 ..... $5,000.00
Opt. 1S $2,500.00
Opt. 2S $1,000.00
Opt. 95 ..... $150.00
TLA7L2 ..... $7,500.00
Opt. 1S $3,750.00
Opt. 2S $2,000.00
Opt. 95 ..... $150.00
TLA7L3 ..... $10,500.00
Opt. 1S $5,250.00
Opt. 2S $3,000.00
Opt. 95 ..... $150.00
TLA7L4 ..... $14,000.00
Opt. 1S $7,000.00
Opt. 2S $4,000.00
Opt. 95 ..... $150.00
TLA7M1 ..... $8,000.00
Opt. 1S $4,000.00
Opt. 95 ..... $150.00
TLA7M2 ..... $13,500.00
Opt. 1S $6,750.00
Opt. 95 ..... $150.00
TLA7M3 ..... $19,500.00
Opt. 1S $9,750.00
Opt. 95 ..... $150.00
TLA7M4 ..... $26,000.00
Opt. 1S $13,000.00
Opt. 95 ..... $150.00
TLA7QS $500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A6 ..... $0.00
TLS216 ..... $27,995.00
Opt. 1B $1,500.00
Opt. 1K $775.00
Opt. 1R $400.00
Opt. 1S $0.00
Opt. 24 ..... $780.00
Opt. 3I $1,450.00
Opt. 3P $1,450.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
TMF101 ..... $250.00
Opt. D9 ..... $100.00
TMF102 ..... $250.00
Opt. D9 ..... $100.00
TMF103 ..... $250.00
Opt. D9 ..... $100.00
TMF104 ..... $250.00
Opt. D9 ..... $100.00
TMF105 ..... $250.00
Opt. D9 ..... $100.00
TMF106 ..... $250.00
Opt. D9 ..... $100.00
TMF107 ..... $250.00
Opt. D9 ..... $100.00
TMF109 ..... $250.00
Opt. D9 ..... $100.00
TMF110 ..... $250.00
Opt. D9 ..... $100.00
TMF140 ..... $250.00
Opt. D9 ..... $100.00
TMF141 ..... $250.00
Opt. D9 ..... $100.00
TMF142 ..... $250.00
Opt. D9 ..... $100.00
TMF161 ..... $250.00
Opt. D9 ..... $100.00
TMF163 ..... $250.00
Opt. D9 ..... $100.00
TMF164 ..... $250.00
Opt. D9 ..... $100.00
TMF201 ..... $250.00
Opt. D9 ..... $100.00
TMF202 ..... $250.00
Opt. D9 ..... $100.00
TMF203 ..... $250.00
Opt. D9 ..... $100.00
TMF204 ..... $250.00
Opt. D9 ..... $100.00
TMF205 ..... $250.00
Opt. D9 ..... $100.00
TMF260 ..... $250.00
Opt. D9 ..... $100.00
TMF261 ..... $250.00
Opt. D9 ..... $100.00
TMF420 ..... $250.00
Opt. D9 ..... $100.00
TMF480 ..... $250.00
Opt. D9 ..... $100.00
TMF501 ..... $250.00
Opt. D9 ..... $100.00
TMF540 ..... $250.00
Opt. D9 ..... $100.00
TMF702 ..... $250.00
Opt. D9 ..... $100.00
TMF801 ..... $250.00
Opt. D9 ..... $100.00
TMF802 ..... $250.00
Opt. D9 ..... $100.00
TMS101 ..... $1,950.00
Opt. 01 ..... $0.00
Opt. D9 ..... $100.00
TMS102 ..... $1,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS103 ..... $1,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS104 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS105 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. D9 ..... $100.00
TMS106 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS107 ..... $3,950.00
Opt. 01 ..... $0.00
Opt. 51 ..... $200.00
Opt. D9 ..... $100.00
TMS109 ..... $4,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 22 ..... $1,200.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS110 ..... $8,950.00
Opt. 01 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS111 ..... $8,950.00
Opt. 01 ..... $0.00
Opt. 22 ..... $1,200.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS140 ..... $1,950.00
Opt. 01 ..... $0.00
Opt. D9 ..... $100.00
TMS141 ..... $2,450.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS142 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 22 ..... $1,200.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS161 ..... $3,450.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS163 ..... $3,950.00
Opt. 01 ..... $0.00
Opt. 12 ..... $1,500.00
Opt. 22 ..... $1,200.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS164 ..... $3,950.00
Opt. 01 ..... $0.00
Opt. 22 ..... $1,200.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS165 ..... $3,950.00
Opt. 21 ..... $1,000.00
TMS201 ..... $1,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
Opt. 04 ..... $0.00
Opt. D9 ..... $100.00
TMS202 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 03 ..... $0.00
Opt. D9 ..... $100.00
TMS203 ..... $3,450.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS204 ..... $4,450.00
Opt. 01 ..... $0.00
Opt. D9 ..... $100.00
TMS205 ..... $4,950.00
Opt. 01 ..... $0.00
Opt. D9 ..... $100.00
TMS220 ..... $3,450.00
Opt. D9 ..... $100.00
TMS260 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS261 ..... $3,950.00
Opt. 01 ..... $0.00
Opt. 22 ..... $1,200.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS420 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS480 ..... $3,950.00
Opt. 01 ..... $0.00
Opt. D9 ..... $100.00
TMS501 ..... $1,950.00
Opt. 01 ..... $0.00
Opt. D9 ..... $100.00
TMS540 ..... $4,500.00
Opt. 11 ..... $1,500.00
Opt. 12 ..... $2,250.00
Opt. 13 ..... $2,250.00
Opt. 14 ..... $2,250.00
Opt. 22 ..... $1,200.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS702 ..... $2,950.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. D9 ..... $100.00
TMS801 ..... $3,450.00
Opt. 01 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. D9 ..... $100.00
TMS802 ..... $2,450.00
Opt. 01 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. D9	$100.00
TOP130	$995.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$100.00
Opt. 39	$0.00
TOP140	$1,255.00
Opt. 30	$100.00
Opt. 31	$0.00
Opt. 32	$100.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$100.00
Opt. 38	$0.00
Opt. 39	$0.00
TOP150	$1,695.00
Opt. 30	$100.00
Opt. 31	$0.00
Opt. 32	$100.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$100.00
Opt. 38	$0.00
Opt. 39	$0.00
TOP160	$3,400.00
Opt. 30	$100.00
Opt. 31	$0.00
Opt. 32	$100.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$100.00
Opt. 38	$0.00
Opt. 39	$0.00
TOP200	$795.00
Opt. 30	$0.00
Opt. 31	$0.00
Opt. 32	$0.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$0.00
Opt. 38	$100.00
Opt. 39	$0.00
TOP300	$1,445.00
Opt. 30	$100.00
Opt. 31	$0.00
Opt. 32	$100.00
Opt. 33	$0.00
Opt. 34	$0.00
Opt. 35	$0.00
Opt. 36	$0.00
Opt. 37	$100.00
Opt. 38	$0.00
Opt. 39	$0.00
TPG20	$14,500.00
Opt. 1M	$0.00
Opt. 2M	$0.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A5	$0.00
TQ82014	$660.00
Opt. 95	$150.00
TQ82015	$1,100.00
Opt. 95	$150.00
Opt. 96	$50.00
TQ82017	$357.00
TQ8210	$860.00
Opt. 95	$150.00
Opt. 96	$50.00
TQ8215	$3,529.00
TQ8325	$19,495.00
Opt. 1R	$550.00
Opt. 95	$150.00
Opt. 96	$50.00
TR14201	$770.00
TR14202	$770.00
TR14203	$770.00
TR14204	$770.00
TR1711	$6,055.00
TR1720	$2,750.00
TR17201	$7,155.00
TR17203	$3,855.00
TR17204	$6,395.00
TR17207	$550.00
TR1722	$2,750.00
TR17291	$1,100.00
TR2114	$2,470.00
TR2724	$5,250.00
TR4154	$14,120.00
TR45103	$1,650.00
TR6143	$5,500.00
TS100	$3,400.00
Opt. 01	$175.00
Opt. 1C	$0.00
Opt. 2C	$0.00
Opt. 3C	$0.00
Opt. 95	$150.00
Opt. L1	$495.00
Opt. L4	$495.00
Opt. L6	$495.00
TSG100	$1,425.00
Opt. 01	$0.00
Opt. 95	$150.00
Opt. 96	$50.00
TSG1001	$18,000.00
Opt. 1Z	–$2,000.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
TSG111	$1,725.00
Opt. 01	$0.00
Opt. 02	$300.00
Opt. 10	$100.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
TSG120	$2,200.00
Opt. 01	$300.00
Opt. 02	$0.00
Opt. 95	$150.00
Opt. 96	$50.00
TSG130A	$2,925.00
Opt. 01	$0.00
Opt. 02	$300.00
Opt. 03	$300.00
Opt. 04	$300.00
Opt. 2J	$300.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
TSG131A	$2,925.00
Opt. 01	$0.00
Opt. 02	$300.00
Opt. 03	$300.00
Opt. 04	$300.00
Opt. 10	$100.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
TSG170A	$5,325.00
Opt. 01	$1,000.00
Opt. 1J	$0.00
Opt. 1V	$0.00
Opt. 2J	$1,000.00
Opt. 95	$150.00
Opt. 96	$50.00
TSG170D	$5,800.00
Opt. 1J	$0.00
Opt. 1S	$1,000.00
Opt. 1V	$0.00
Opt. 95	$150.00
Opt. 96	$50.00
TSG200	$2,325.00
Opt. 1J	$0.00
Opt. 95	$150.00
Opt. 96	$50.00
TSG271	$5,250.00
Opt. 01	$635.00
Opt. 05	$0.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
TSG422	$5,650.00
Opt. 1S	$1,000.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
TSG601	$2,995.00
Opt. 01	$55.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A6	$0.00
TSG95	$895.00
Opt. 01	$55.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A6	$0.00
TTIP	$525.00
TV110	$2,995.00
Opt. 1C	$0.00
Opt. 2C	$0.00
Opt. 3C	$0.00
Opt. 95	$150.00
TV1330	$20,550.00
Opt. 11	$0.00
Opt. 13	$0.00
Opt. 14	$0.00
Opt. 21	$0.00
Opt. 23	$0.00
Opt. 24	$0.00
Opt. 30	$0.00
TV1340	$20,550.00
Opt. 10	$0.00
Opt. 20	$0.00
Opt. 23	$0.00
Opt. 31	$0.00
Opt. 40	$0.00
Opt. 41	$0.00
Opt. 46	$0.00
Opt. 95	$580.00
TV1350	$24,150.00
Opt. 01	$2,250.00
Opt. 02	$0.00
Opt. 10	$0.00
Opt. 11	$0.00
Opt. 16	$3,000.00
Opt. 20	$3,000.00
Opt. 21	$3,000.00
Opt. 22	$3,000.00
Opt. 23	$3,000.00
Opt. 24	$3,000.00
Opt. 25	$3,000.00
Opt. 26	$3,000.00
Opt. 27	$3,000.00
Opt. 28	$3,000.00
Opt. 29	$3,000.00
Opt. 30	$3,000.00
Opt. 31	$3,000.00
Opt. 40	$3,000.00
Opt. 41	$3,000.00
Opt. 42	$3,000.00
Opt. 43	$3,000.00
Opt. 44	$3,000.00
Opt. 45	$3,000.00
Opt. 46	$3,000.00
Opt. 95	$580.00
TVA001	$350.00
TVGF01	$1,200.00
Opt. 2J	$0.00
TVGF02	$760.00
TVGF03	$400.00
TVGF10	$200.00
TVGF11A	$100.00
TVGF13	$200.00
TVGF14	$200.00
TVGF15	$225.00
TVGF1S	$1,000.00
Opt. 1V	$0.00
TVGF1SB	$1,000.00
TVGF1V	$350.00
Opt. 01	$0.00
TVS621	$6,450.00
Opt. 95	$150.00
TVS621A	$6,800.00
Opt. 95	$150.00
TVS625	$18,500.00
Opt. 95	$150.00
TVS625A	$14,500.00
Opt. 95	$150.00
TVS641	$11,500.00
Opt. 95	$150.00
TVS641A	$11,800.00
Opt. 95	$150.00
TVS645	$25,595.00
Opt. 95	$150.00
TVS645A	$25,900.00
Opt. 95	$150.00
TXMDXPB	$99.00
U3641	$15,800.00
Opt. 15	$700.00
Opt. 20	$900.00
Opt. 70	$4,995.00
Opt. 72	$10,000.00
Opt. 74	$5,495.00
Opt. 78	$500.00
Opt. 95	$150.00
Opt. 96	$50.00
U3641N	$15,800.00
Opt. 15	$700.00
Opt. 20	$900.00
Opt. 72	$10,000.00
Opt. 74	$5,495.00
Opt. 78	$500.00

**1 Contact your local Tektronix representative for price information.*

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 95	$150.00
Opt. 96	$50.00
U37DITS	$0.00
U3FT400	$395.00
U4941	$14,500.00
Opt. 95	$150.00
Opt. 96	$50.00
U4941N	$14,500.00
UAFM	$22,250.00
UDS5	$3,500.00
UPD-B5	$1,138.00
UPD-K2	$553.00
UPD04	$18,290.00
Opt. 95	$800.00
Opt. B1	$1,100.00
Opt. B2	$1,990.00
Opt. B3	$4,260.00
Opt. B4	$1,290.00
UPD05	$21,750.00
Opt. 95	$382.00
Opt. 96	$382.00
Opt. B1	$1,100.00
Opt. B2	$1,990.00
Opt. B3	$4,260.00
Opt. B4	$1,290.00
UPDK1	$1,100.00
UPIK100	$495.00
UPIK132	$495.00
UPIK196	$2,500.00
UPIK3M	$495.00
UPIK44	$495.00
UPIK52	$495.00
UPIK68	$495.00
UPIK84	$495.00
UPL	$14,795.00
Opt. 01	$3,165.00
Opt. 1R	$195.00
Opt. 95	$310.00
Opt. B1	$1,265.00
Opt. B10	$0.00
Opt. B2	$1,900.00
Opt. B21	$0.00
Opt. B22	$0.00
Opt. B4	$0.00
Opt. B5	$750.00
Opt. Z1	$95.00
Opt. B1	$1,265.00
Opt. B10	$0.00
Opt. B2	$1,900.00
Opt. B21	$0.00
Opt. B22	$0.00
Opt. B4	$0.00
Opt. B5	$750.00
Opt. Z1	$75.00
URE2	$4,050.00
Opt. 95	$225.00
URE3	$5,500.00
Opt. 01	$765.00
Opt. 95	$225.00
URV3502	$2,750.00
URV3503	$2,850.00
URV5	$5,995.00
Opt. 01	$525.00
Opt. 1R	$340.00
Opt. 95	$200.00
URV55	$3,400.00
URV5Z1	$450.00
Opt. 95	$95.00
URV5Z2	$1,125.00
URV5Z25	$1,125.00
URV5Z26	$1,450.00
URV5Z44	$1,395.00
Opt. 95	$95.00
URV5Z45	$1,525.00
Opt. 95	$95.00
URV5Z46	$1,395.00
Opt. 95	$95.00
URV5Z47	$1,525.00
Opt. 95	$95.00
URV5Z70	$1,295.00
Opt. 95	$95.00
URV5Z72	$1,295.00
Opt. 95	$95.00
URV5Z9	$1,425.00
URVZ	$225.00
URVZ3	$595.00
URVZ4	$1,750.00
URVZ50	$320.00
URVZ6	$400.00
URVZ7	$1,395.00
URVZ8	$1,095.00
UZ-22	$287.00
UZ-35	$60.00
VITS100	$2,550.00
Opt. 02	$0.00
Opt. 1J	$0.00
Opt. 1M	$250.00
Opt. 95	$150.00
Opt. 96	$50.00
VITS200	$5,375.00
Opt. 1C	$0.00
Opt. 1J	$0.00
Opt. 95	$150.00
Opt. 96	$50.00
VITS201	$4,350.00
Opt. 05	$0.00
Opt. 10	$0.00
Opt. 15	$0.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
VM100	$5,050.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
VM101	$5,050.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
VM140	$9,490.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
VM141	$9,490.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
VM700T	$19,150.00
Opt. 01	$4,600.00
Opt. 11	$4,600.00
Opt. 1C	$0.00
Opt. 1F	$1,795.00
Opt. 1G	$950.00
Opt. 1P	$700.00
Opt. 1Z	$500.00
Opt. 20	$3,200.00
Opt. 21	$4,750.00
Opt. 30	$2,750.00
Opt. 3Z	$1,500.00
Opt. 40	$4,395.00
Opt. 41	$4,795.00
Opt. 42	$1,700.00
Opt. 48	$2,795.00
Opt. 74	$100.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
VM7FC1	$350.00
VM7FP1	$650.00
VM7FR1	$350.00
VMA	$50.00
Opt. 1G	$950.00
Opt. 20	$3,200.00
Opt. 21	$4,750.00
Opt. 30	$2,750.00
Opt. 3B	$3,900.00
Opt. 3D	$1,500.00
Opt. 40	$4,395.00
Opt. 41	$4,600.00
Opt. 42	$1,700.00
Opt. 48	$2,795.00
VMBKUP	$300.00
VMCONF	$65.00
Opt. 01	$0.00
Opt. 11	$0.00
VMCONFG	$65.00
VMREMGR	$300.00
VMT	$195.00
VMTB	$4,995.00
Opt. 1G	$950.00
Opt. 20	$3,200.00
Opt. 21	$4,750.00
Opt. 30	$2,750.00
Opt. 3B	$3,900.00
Opt. 3D	$1,500.00
Opt. 40	$4,395.00
Opt. 41	$4,795.00
Opt. 42	$1,700.00
Opt. 48	$2,795.00
VMTX	$5,995.00
Opt. 1G	$950.00
Opt. 20	$3,200.00
Opt. 21	$4,750.00
Opt. 30	$2,750.00
Opt. 3B	$5,995.00
Opt. 3D	$1,500.00
Opt. 40	$4,395.00
Opt. 41	$4,795.00
Opt. 42	$1,700.00
Opt. 48	$2,795.00
VMUPG	$1.00
Opt. 1G	$800.00
Opt. 20	$3,000.00
Opt. 21	$4,500.00
Opt. 30	$2,500.00
Opt. 3B	$3,900.00
Opt. 3D	$1,500.00
Opt. 40	$4,000.00
Opt. 41	$4,600.00
Opt. 42	$1,500.00
Opt. 48	$2,500.00
VNA	$18,990.00
VNA 95	$591.00
VS210	$8,395.00
Opt. 1A	$4,400.00
Opt. 1S	$1,695.00
Opt. 2A	$5,200.00
Opt. 3A	$6,000.00
Opt. 95	$150.00
Opt. 96	$50.00
Opt. F1	$1,995.00
Opt. F2	$1,695.00
VS211F3	$1,595.00
VS21AF1	$1,695.00
VX1406	$3,895.00
Opt. 1R	$395.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
VX1410	$6,495.00
Opt. 1D	–$1,660.00
Opt. 1M	$920.00
Opt. 1R	$375.00
Opt. 1U	$140.00
Opt. 2M	$650.00
Opt. 2R	$585.00
Opt. 2U	$315.00
Opt. 3R	$260.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
Opt. X3	$780.00
VX1411	$5,495.00
Opt. 1R	$375.00
Opt. 1U	$140.00
Opt. 2R	$585.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
Opt. X3	$660.00
VX1630	$685.00
VX1630S	$210.00
VX1640S	$200.00
VX1650	$465.00
VX1650S	$130.00
VX1657P	$315.00
VX1657S	$305.00
VX1660	$482.00
VX1661	$85.00
VX1662	$125.00
VX1663	$270.00
VX1664	$135.00
VX1665	$250.00
VX1666	$335.00
VX1667	$360.00
VX1681A	$155.00
VX1682	$31.00
VX1683	$26.00
VX1727	$230.00
VX1729	$82.00
Opt. 01	$0.00
Opt. 03	$0.00
Opt. AA	$0.00
VX1730	$60.00
Opt. 01	$0.00
Opt. 03	$0.00
Opt. 7L	$35.00
Opt. AA	$0.00
VX1731	$50.00
VX1732	$160.00
VX1733	$260.00
VX1734	$260.00
VX1735	$155.00
VX1742P	$130.00
VX1744	$170.00
VX1745	$190.00
VX1746	$305.00
VX1757	$123.00
VX1770	$60.00
VX1780P	$54.00
VX1780S	$54.00
VX1782P	$38.00
VX1783P	$33.00
VX1783S	$33.00
VX1784P	$27.00
VX1784S	$27.00
VX1785S	$38.00
VX1786P	$38.00
VX1786S	$38.00
VX4224	$4,665.00
Opt. 01	$550.00
Opt. 03	$1,025.00
Opt. X1	$415.00
Opt. X2	$690.00
Opt. 2R	$585.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
Opt. X3	$660.00
VX1630	$685.00
VX1630S	$210.00
VX1640S	$200.00
VX1650	$465.00
VX1650S	$130.00
VX1657P	$315.00
VX1657S	$305.00
VX1660	$482.00
VX1661	$85.00
VX1662	$125.00
VX1663	$270.00
VX1664	$135.00
VX1665	$250.00
VX1666	$335.00
VX1667	$360.00
VX1681A	$155.00
VX1682	$31.00
VX1683	$26.00
VX1727	$230.00
VX1729	$82.00
Opt. 01	$0.00
Opt. 03	$0.00
Opt. AA	$0.00
VX1730	$60.00
Opt. 01	$0.00
Opt. 03	$0.00
Opt. 7L	$35.00
Opt. AA	$0.00
VX1731	$50.00
VX1732	$160.00
VX1733	$260.00
VX1734	$260.00
VX1735	$155.00
VX1742P	$130.00
VX1744	$170.00
VX1745	$190.00
VX1746	$305.00
VX1757	$123.00
VX1770	$60.00
VX1780P	$54.00
VX1780S	$54.00
VX1782P	$38.00
VX1783P	$33.00
VX1783S	$33.00
VX1784P	$27.00
VX1784S	$27.00
VX1785S	$38.00
VX1786P	$38.00
VX1786S	$38.00
VX4224	$4,665.00
Opt. 01	$550.00
Opt. 03	$1,025.00
Opt. X1	$415.00
Opt. X2	$690.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. X3	$830.00
VX4234	$1,850.00
Opt. X1	$90.00
Opt. X2	$150.00
Opt. X3	$180.00
VX4237	$4,525.00
Opt. X1	$515.00
Opt. X2	$855.00
Opt. X3	$1,025.00
VX4240	$7,850.00
Opt. 02	$1,100.00
Opt. X1	$425.00
Opt. X2	$705.00
Opt. X3	$845.00
VX4244	$12,900.00
Opt. X1	$720.00
Opt. X2	$1,200.00
Opt. X3	$1,440.00
VX4286	$2,880.00
Opt. 01	$455.00
Opt. 1A	$232.00
Opt. 1B	$232.00
Opt. 1C	$232.00
Opt. 2A	$232.00
Opt. 2B	$232.00
Opt. 2C	$232.00
Opt. 3A	$232.00
Opt. 3B	$232.00
Opt. 3C	$232.00
Opt. 4A	$232.00
Opt. 4B	$232.00
Opt. 4C	$232.00
Opt. X1	$155.00
Opt. X2	$255.00
Opt. X3	$310.00
VX4287	$3,925.00
Opt. X1	$215.00
Opt. X2	$360.00
Opt. X3	$430.00
VX4320	$2,775.00
Opt. 01	$595.00
Opt. X3	$326.00
VX4330	$2,900.00
Opt. 01	$595.00
Opt. X3	$368.00
VX4342	$2,650.00
Opt. 01	$230.00
Opt. 02	$435.00
Opt. 10	$315.00
Opt. 13	$205.00
Opt. 1M	$225.00
Opt. AA	$415.00
VX4350	$2,260.00
Opt. 01	$595.00
Opt. X3	$278.00
VX4351	$1,950.00
Opt. 01	$575.00
Opt. X3	$235.00
VX4353	$2,095.00
Opt. X1	$85.00
Opt. X2	$140.00
Opt. X3	$170.00
VX4356	$1,910.00
Opt. X1	$85.00
Opt. X2	$145.00
Opt. X3	$175.00
VX4357	$2,025.00
Opt. X1	$100.00
Opt. X2	$170.00
Opt. X3	$205.00
VX4380	$4,280.00
Opt. 01	$595.00
Opt. X3	$566.00
VX4381	$2,200.00
Opt. 01	$575.00
Opt. X3	$265.00
VX4428	$8,450.00
Opt. 10	$850.00
Opt. X1	$455.00
Opt. X2	$755.00
Opt. X3	$910.00
VX4428F	$8,295.00
VX4469A	$6,695.00
Opt. 01	$3,895.00
Opt. 02	$7,525.00
VX4570	$4,850.00
Opt. X1	$270.00
Opt. X2	$450.00
Opt. X3	$540.00
VX4610	$34,000.00
Opt. 02	$4,100.00
Opt. 03	$8,400.00
Opt. 04	$16,900.00
Opt. 22	$6,800.00
Opt. 36	$8,800.00
Opt. 96	$50.00
Opt. X1	$2,400.00
Opt. X2	$4,000.00
Opt. X3	$4,800.00
VX46F01	$1,900.00
Opt. 96	$50.00
VX46F02	$3,900.00
VX46F03	$9,400.00
Opt. 96	$50.00
VX46F04	$17,900.00
Opt. 96	$50.00
VX46F22	$7,700.00
VX46F36	$9,700.00
VX4730	$4,125.00
Opt. 10	–$550.00
Opt. X1	$230.00
Opt. X2	$380.00
Opt. X3	$455.00
VX4750	$6,450.00
Opt. X1	$360.00
Opt. X2	$600.00
Opt. X3	$720.00
VX4780	$5,350.00
Opt. X3	$720.00
VX4790A	$3,825.00
Opt. 01	$660.00
Opt. 02	$1,315.00
Opt. 1M	$660.00
Opt. X1	$235.00
Opt. X2	$390.00
Opt. X3	$470.00
VX4792	$8,995.00
Opt. 1S	$695.00
Opt. 95	$150.00
Opt. X1	$600.00
Opt. X2	$1,000.00
Opt. X3	$1,200.00
VX4801	$2,055.00
Opt. X1	$115.00
Opt. X2	$190.00
Opt. X3	$225.00
VX4802	$2,055.00
Opt. 01	$57.00
Opt. 02	$57.00
Opt. X1	$115.00
Opt. X2	$190.00
Opt. X3	$225.00
VX4820	$6,330.00
Opt. 11	–$3,150.00
Opt. X1	$360.00
Opt. X2	$600.00
Opt. X3	$720.00
VX4GBD	$3,100.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
VX7792	$27,285.00
VXI700	$4,995.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$0.00
Opt. 04	$1,995.00
Opt. 05	$1,995.00
Opt. 06	$295.00
Opt. 07	$2,290.00
Opt. 08	$2,290.00
Opt. 09	$265.00
Opt. 10	$525.00
Opt. 11	$45.00
VXI700E	$5,995.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$0.00
Opt. 04	$1,995.00
Opt. 05	$1,995.00
Opt. 06	$295.00
Opt. 07	$2,290.00
Opt. 08	$2,290.00
Opt. 09	$265.00
Opt. 10	$525.00
Opt. 11	$45.00
Opt. 12	$130.00
VXI833	$10,000.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$265.00
Opt. 04	$525.00
Opt. 05	$130.00
Opt. 06	$45.00
Opt. 07	$60.00
Opt. 08	$0.00
Opt. 09	$1,995.00
Opt. 10	$1,995.00
Opt. 11	$295.00
Opt. 12	$2,295.00
Opt. 13	$2,295.00
VXI866	$13,000.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$265.00
Opt. 04	$525.00
Opt. 05	$130.00
Opt. 06	$45.00
Opt. 07	$60.00
Opt. 08	$0.00
Opt. 09	$1,995.00
Opt. 10	$1,995.00
Opt. 11	$295.00
Opt. 12	$2,295.00
Opt. 13	$2,295.00
VXIGPIB	$1,800.00
VXOA41	$8,125.00
Opt. 01	–$245.00
Opt. 02	–$245.00
Opt. 03	–$245.00
Opt. 96	$58.00
Opt. X1	$475.00
Opt. X2	$795.00
Opt. X3	$950.00
VXP64C	$3,245.00
Opt. X1	$180.00
Opt. X2	$300.00
Opt. X3	$360.00
VXP64T	$3,245.00
Opt. X1	$180.00
Opt. X2	$300.00
Opt. X3	$360.00
VXSK700	$11,150.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$0.00
Opt. 04	$1,995.00
Opt. 05	$1,995.00
Opt. 06	$295.00
Opt. 07	$2,290.00
Opt. 08	$2,290.00
Opt. 09	$265.00
Opt. 10	$525.00
Opt. 11	$45.00
Opt. 1M	$920.00
Opt. 1R	$375.00
Opt. 1U	$140.00
Opt. 2R	$585.00
Opt. 2U	$315.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
VXSK70E	$12,100.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$0.00
Opt. 04	$1,995.00
Opt. 05	$1,995.00
Opt. 06	$295.00
Opt. 07	$2,290.00
Opt. 08	$2,290.00
Opt. 09	$265.00
Opt. 10	$525.00
Opt. 11	$45.00
Opt. 12	$130.00
Opt. 1M	$920.00
Opt. 1R	$375.00
Opt. 1U	$140.00
Opt. 2R	$585.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
VXSK833	$16,000.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$265.00
Opt. 04	$525.00
Opt. 05	$130.00
Opt. 06	$45.00
Opt. 07	$60.00
Opt. 08	$0.00
Opt. 09	$1,995.00
Opt. 10	$1,995.00
Opt. 11	$295.00
Opt. 12	$2,295.00
Opt. 13	$2,295.00
Opt. 1M	$920.00
Opt. 1R	$375.00
Opt. 1U	$140.00
Opt. 2R	$585.00
Opt. 2U	$315.00
Opt. A1	$0.00
Opt. A2	$0.00
Opt. A3	$0.00
Opt. A4	$0.00
Opt. A5	$0.00
VXSK866	$18,910.00
Opt. 01	$1,995.00
Opt. 02	$1,995.00
Opt. 03	$265.00
Opt. 04	$525.00
Opt. 05	$130.00
Opt. 06	$45.00
Opt. 07	$60.00
Opt. 08	$0.00
Opt. 09	$1,995.00
Opt. 10	$1,995.00
Opt. 11	$295.00
Opt. 12	$2,295.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 13 ..... $2,295.00
Opt. 1M $920.00
Opt. 1R $375.00
Opt. 1U $140.00
Opt. 2R $585.00
Opt. 2U $315.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
VXSKGPB $8,050.00
Opt. 1M $920.00
Opt. 1R $375.00
Opt. 1U $140.00
Opt. 2R $585.00
Opt. 2U $315.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
VXSKMX2 ..... $10,665.00
Opt. 01 ..... $105.00
Opt. 02 ..... $315.00
Opt. 04 ..... $45.00
Opt. 05 ..... $0.00
Opt. 06 ..... $200.00
Opt. 12 ..... $210.00
Opt. 14 ..... $245.00
Opt. 1M $920.00
Opt. 1R $375.00
Opt. 1U $140.00
Opt. 22 ..... $350.00
Opt. 24 ..... $380.00
Opt. 2R $585.00
Opt. 2U $315.00
WFM300A $4,595.00
Opt. 05 ..... –$100.00
Opt. 10 ..... $0.00
Opt. 14 ..... $0.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
WFM601A $5,295.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
WFM601E $6,995.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
WFM601M $8,595.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
WFM90 ..... $1,995.00
Opt. 01 ..... $90.00
Opt. 33 ..... $235.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A6 ..... $0.00
WFM91 ..... $1,995.00
Opt. 01 ..... $90.00
Opt. 33 ..... $225.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A6 ..... $0.00
WM780J $7,420.00
WSTR31 ..... $295.00
WSTR31U $100.00
WVR500 ..... $1,845.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
XSRM $27,000.00
Opt. 95 ..... $300.00
Opt. Z3 ..... $2,900.00
Opt. ZC $760.00
Opt. ZF $3,335.00
Opt. ZL $1,575.00
Opt. ZP $4,860.00
Opt. ZR $760.00
YT1S $1,100.00
YT5060 ..... $45.00
YT5100 ..... $50.00
ZCAN52 ..... $3,225.00
ZCAN72 ..... $3,350.00
ZRB252 ..... $3,395.00
ZRB253 ..... $1,930.00
ZRB255 ..... $3,395.00
ZRB256 ..... $1,930.00
ZRB273 ..... $2,025.00
ZRB276 ..... $2,025.00
ZRC52 ..... $4,450.00
ZZA12 ..... $530.00
ZZA123 ..... $460.00
ZZA8 ..... $380.00
ZZA91 ..... $175.00
ZZA911 ..... $75.00
ZZA92 ..... $195.00
ZZA921 ..... $90.00
ZZA93 ..... $195.00
ZZA931 ..... $90.00
ZZA94 ..... $195.00
ZZA941 ..... $95.00
ZZA95 ..... $200.00
ZZA951 ..... $100.00
ZZA97 ..... $345.00
ZZA98 ..... $380.00
ZZA99 ..... $450.00
ZZA991 ..... $405.00
ZZG93 ..... $105.00
ZZG94 ..... $110.00
ZZG95 ..... $115.00
ZZK-014 ..... $770.00
ZZK011 ..... $620.00
ZZK1 ..... $355.00
ZZK933 ..... $705.00
ZZK934 ..... $730.00
ZZK943 ..... $720.00
ZZK944 ..... $770.00
ZZK945 ..... $825.00
ZZK953 ..... $750.00
ZZK954 ..... $800.00
ZZK955 ..... $840.00
ZZK973 ..... $550.00
ZZK983 ..... $575.00
ZZM32 ..... $82.00
ZZM512 ..... $1,155.00
ZZT91 ..... $115.00
ZZT92 ..... $135.00
ZZT96 ..... $90.00
ZZT97 ..... $130.00
ZZT98 ..... $215.00
003067501 ..... $7.50
003082300 ..... $42.00
003082500 ..... $10.00
003138300 ..... $41.00
003143300 ..... $1.25
003143301 ..... $10.00
003149300 ..... $25.00
003149400 ..... $385.00
006682200 ..... $120.00
006682400 ..... $125.00
006682500 ..... $990.00
006682600 ..... $150.00
006735000 ..... $400.00
006758000 ..... $20.00
010037600 ..... $205.00
010037700 ..... $265.00
010038400 ..... $205.00
010041900 ..... $295.00
010646503 ..... $3,200.00
011004901 ..... $40.00
011005501 ..... $50.00
011005701 ..... $55.00
011005902 ..... $60.00
011006002 ..... $60.00
011006100 ..... $129.00
011006902 ..... $60.00
011007602 ..... $60.00
011009200 ..... $46.00
011009900 ..... $50.00
011010001 ..... $170.00
011010201 ..... $33.00
011010300 ..... $37.00
011010302 ..... $45.00
011010500 ..... $205.00
011010600 ..... $255.00
011011200 ..... $115.00
011011800 ..... $140.00
011012800 ..... $88.00
011012900 ..... $220.00
011014800 ..... $1,935.00
011015500 ..... $780.00
012003100 ..... $13.75
012003900 ..... $13.75
012005701 ..... $25.00
012007401 ..... $34.00
012007402 ..... $40.00
012007600 ..... $20.00
012009000 ..... $11.25
012009100 ..... $11.50
012012800 ..... $280.00
012015700 ..... $165.00
012017900 ..... $10.00
012018100 ..... $10.00
012020800 ..... $28.00
012036401 ..... $42.00
012048200 ..... $25.00
012063001 ..... $150.00
012074701 ..... $55.00
012080000 ..... $63.00
012099100 ..... $195.00
012099101 ..... $195.00
012099102 ..... $315.00
012122000 ..... $850.00
012122100 ..... $935.00
012124100 ..... $85.00
012128200 ..... $170.00
012128400 ..... $38.00
012128500 ..... $50.00
012129800 ..... $45.00
012131400 ..... $75.00
012133700 ..... $55.00
012133800 ..... $55.00
012133900 ..... $55.00
012134100 ..... $20.00
012134200 ..... $60.00
012136300 ..... $11.50
012136400 ..... $55.00
012138000 ..... $75.00
012138700 ..... $25.00
012139200 ..... $70.00
012139800 ..... $39.00
012140300 ..... $35.00
012141100 ..... $70.00
012144700 ..... $32.00
012145000 ..... $27.00
012146900 ..... $160.00
012147000 ..... $50.00
012147100 ..... $50.00
012147300 ..... $13.00
012148200 ..... $36.00
012148300 ..... $99.00
012148400 ..... $55.00
012148500 ..... $125.00
013005200 ..... $25.00
013005400 ..... $115.00
013005600 ..... $40.00
013007100 ..... $10.00
013007101 ..... $27.00
013007601 ..... $32.00
013008401 ..... $16.75
013008402 ..... $16.75
013008500 ..... $21.00
013008501 ..... $17.50
013009701 ..... $20.00
013010702 ..... $10.00
013010707 ..... $5.75
013010708 ..... $5.75
013012600 ..... $95.00
013013500 ..... $15.00
013014500 ..... $125.00
013019500 ..... $22.00
013019700 ..... $195.00
013020202 ..... $15.00
013020802 ..... $6.50
013022600 ..... $15.75
013022700 ..... $84.00
013024000 ..... $7.50
013024200 ..... $15.00
013025400 ..... $100.00
013025801 ..... $105.00
013027101 ..... $685.00
013027800 ..... $350.00
013028000 ..... $15.75
013029001 ..... $22.00
013029002 ..... $22.00
013029100 ..... $67.00
015005802 ..... $315.00
015010600 ..... $1,590.00
015010601 ..... $1,590.00
015019000 ..... $680.00
015020107 ..... $9.50
015022200 ..... $1.90
015026500 ..... $415.00
015032500 ..... $23.00
015033000 ..... $51.00
015033900 ..... $65.00
015033901 ..... $180.00
015036900 ..... $70.00
015054900 ..... $185.00
015055400 ..... $47.00
015056000 ..... $595.00
015056200 ..... $515.00
015057200 ..... $30.00
015060100 ..... $115.00
015060150 ..... $105.00
015064200 ..... $60.00
015066600 ..... $80.00
015067250 ..... $150.00
015100200 ..... $210.00
015100400 ..... $60.00
015100500 ..... $345.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

015100600 ..... $325.00	**016109901** $150.00	**062996200** $1,300.00	**103035000** $1,120.00	Opt. A1 ..... $0.00
015100700 ..... $250.00	**016113500** $675.00	**063022200** $300.00	**103035100** $690.00	Opt. A2 ..... $0.00
015100800 ..... $285.00	**016114500** $120.00	**063032700** $600.00	**103035200** $975.00	Opt. A3 ..... $0.00
015100900 ..... $70.00	**016115400** $156.00	**063041600** $850.00	**103035300** $380.00	**119184702** $325.00
015101100 ..... $33.00	**016115700** $625.00	**063069800** $1,300.00	**103035900** $610.00	**119204300** $60.00
015101200 ..... $12.75	**016115801** $140.00	**063223600** $72.10	**103036500** $25.00	**119448800** $55.00
015101400 ..... $315.00	**016115900** $50.00	**067068101** $630.00	**103036600** $25.00	**119481200** $25.00
015101600 ..... $50.00	**016116600** $400.00	**068025100** $60.00	**103036700** $25.00	**119486300** $300.00
015101700 ..... $40.00	**016118100** $145.00	**068025101** $60.00	**103037300** $955.00	**119495400** $12,800.00
015101800 ..... $14.25	**016121000** $275.00	**068025102** $60.00	**103037400** $715.00	**119495500** $10,020.00
015101900 ..... $335.00	**016123900** $1,850.00	**068025103** $60.00	**103037500** $490.00	**119495600** $8,110.00
015102000 ..... $31.00	**016126800** $100.00	**068025104** $60.00	**103037600** $555.00	**119495700** $8,410.00
015102100 ..... $35.00	**016128900** $30.00	**068025106** $70.00	**103037700** $470.00	**119495800** $12,950.00
015102200 ..... $50.00	**016131500** $12.00	**068025107** $70.00	**103037800** $1,107.00	**119503200** $34.00
016001503 ..... $550.00	**016133100** $75.00	**068025200** $60.00	**103037900** $1,312.00	**119507900** $510.00
016011101 ..... $33.00	**016139901** $85.00	**068025201** $60.00	**103038000** $1,255.00	**119508200** $450.00
016019104 ..... $180.00	**016146100** $27.00	**068025202** $60.00	**103038100** $465.00	**120188300** $265.00
016019505 ..... $65.00	**017006100** $590.00	**068025203** $60.00	**103038200** $830.00	**120188400** $250.00
016024801 ..... $350.00	**017006200** $155.00	**068025204** $60.00	**103038300** $765.00	**122018601** $105.00
016024906 ..... $250.00	**017006300** $95.00	**068025206** $70.00	**103038400** $794.00	**122075100** $16.00
016026903 ..... $200.00	**017007600** $375.00	**068025207** $70.00	**103038500** $750.00	**122089501** $115.00
016030101 ..... $300.00	**017008200** $1,450.00	**068025300** $60.00	**103038600** $510.00	**131025800** $3.50
016030601 ..... $155.00	**017008800** $450.00	**068025301** $60.00	**103038700** $574.00	**131130200** $1.25
016032701 ..... $270.00	**017008900** $93.00	**068025302** $60.00	**103038800** $1,020.00	**131250904** $110.00
016035701 ..... $29.00	**017009100** $310.00	**068025303** $60.00	**103038900** $1,360.00	**131276601** $47.00
016035703 ..... $48.00	**017009400** $260.00	**068025304** $60.00	**103039000** $500.00	**131276603** $2.35
016035903 ..... $50.00	**020067202** $100.00	**068025306** $70.00	**103039100** $945.00	**131419900** $100.00
016036202 ..... $105.00	**020138601** $60.00	**068025307** $70.00	**103039200** $660.00	**131421000** $7.50
016051200 ..... $36.00	**020151400** $75.00	**068025400** $60.00	**103039300** $890.00	**131424400** $115.00
016056600 ..... $40.00	**020151500** $75.00	**068025401** $60.00	**103039400** $710.00	**131428000** $2.25
016059200 ..... $20.00	**020169200** $10,955.00	**068025402** $60.00	**103039500** $825.00	**131435300** $66.00
016061200 ..... $195.00	**020169300** $2,740.00	**068025403** $60.00	**103040300** $15.00	**131447400** $1.65
016062202 ..... $48.00	**020170800** $225.00	**068025404** $60.00	**1101A** $895.00	**131473000** $57.00
016063300 ..... $5.75	**020171101** $50.00	**068025406** $70.00	Opt. A1 ..... $0.00	**131499701** $6.25
016065800 ..... $1,240.00	**020172401** $47.00	**068025407** $70.00	Opt. A2 ..... $0.00	**131499702** $150.00
016065900 ..... $190.00	**020183501** $105.00	**068034401** $60.00	Opt. A3 ..... $0.00	**131503000** $66.00
016067702 ..... $50.00	**020183601** $65.00	**068034402** $60.00	Opt. A4 ..... $0.00	**131503100** $66.00
016069201 ..... $100.00	**020188500** $450.00	**068034403** $60.00	Opt. A5 ..... $0.00	**131530800** $1.65
016070800 ..... $1.05	**020190800** $17.00	**070040102** $5.00	**1103** $825.00	**131530900** $1.65
016072000 ..... $41.00	**020199300** $49.00	**070667401** $35.00	Opt. A1 ..... $0.00	**131534200** $60.00
016079201 ..... $455.00	**020199301** $49.00	**103001500** $16.00	Opt. A2 ..... $0.00	**131534201** $70.00
016079901 ..... $145.00	**020200800** $145.00	**103002800** $7.50	Opt. A3 ..... $0.00	**131548200** $29.00
016081903 ..... $330.00	**020203101** $11.50	**103002900** $10.00	Opt. A5 ..... $0.00	**131572700** $1.60
016082900 ..... $205.00	**020207000** $350.00	**103003000** $10.00	**11801B** $25,000.00	**131577700** $2.00
016083302 ..... $425.00	**020208000** $1,110.00	**103003100** $10.00	Opt. 1M $1,200.00	**131595401** $100.00
016084402 ..... $640.00	**020209200** $50.00	**103003200** $10.25	Opt. 1R $255.00	**134001300** $1.25
016084500 ..... $665.00	**020210600** $37.00	**103003300** $22.00	Opt. 95 ..... $150.00	**134001600** $2.10
016084800 ..... $28.00	**020213700** $45.00	**103003500** $15.00	Opt. A1 ..... $0.00	**134001601** $5.80
016085700 ..... $50.00	**020214000** $48.00	**103004500** $23.00	Opt. A2 ..... $0.00	**1350F01** $3,400.00
016087600 ..... $26.00	**021045700** $355.00	**103015800** $16.50	Opt. A3 ..... $0.00	**1350F05** $355.00
016087700 ..... $14.75	**021045801** $475.00	**103016400** $28.00	Opt. A4 ..... $0.00	**1405** $8,755.00
016087800 ..... $14.75	**039000500** $1,600.00	**103017701** $11.50	Opt. A5 ..... $0.00	Opt. 01 ..... $250.00
016087900 ..... $14.75	**039000600** $610.00	**103032400** $45.00	**118902300** $26.00	Opt. 03 ..... $0.00
016088602 ..... $550.00	**040098204** $250.00	**103033400** $16.75	**118AS** $6,000.00	Opt. A1 ..... $0.00
016089700 ..... $685.00	**040121403** $330.00	**103034200** $770.00	Opt. 95 ..... $150.00	Opt. A2 ..... $0.00
016090901 ..... $225.00	**040127902** $455.00	**103034300** $830.00	Opt. 96 ..... $50.00	Opt. A3 ..... $0.00
016093900 ..... $14.75	**040148700** $62.00	**103034400** $640.00	Opt. A1 ..... $0.00	Opt. A4 ..... $0.00
016094000 ..... $18.00	**062947100** $150.00	**103034500** $675.00	Opt. A2 ..... $0.00	Opt. A5 ..... $0.00
016094100 ..... $14.75	**062995500** $850.00	**103034600** $805.00	Opt. A3 ..... $0.00	**146001700** $3.25
016101901 ..... $705.00	**062996000** $850.00	**103034700** $650.00	**118F01** $1,250.00	**146003302** $120.00
016107700 ..... $17.00	**062996100** $1,300.00	**103034900** $1,025.00	**118RC** $1,100.00	**1502C** $7,775.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 03 ..... $295.00
Opt. 04 ..... $1,100.00
Opt. 05 ..... $0.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. DE $0.00
1503C $5,650.00
Opt. 03 ..... $295.00
Opt. 04 ..... $1,100.00
Opt. 05 ..... $0.00
Opt. 06 ..... $495.00
Opt. 08 ..... $295.00
Opt. 09 ..... $295.00
Opt. 10 ..... $395.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
Opt. DE $0.00
156295300 ..... $4.30
159018300 ..... $0.85
159028700 ..... $21.00
159033700 ..... $9.00
159035500 ..... $2.65
159035700 ..... $8.25
161010400 ..... $12.25
161023001 ..... $10.25
166040401 ..... $1.85
166055700 ..... $1.90
1700F00 ..... $85.00
1700F02 ..... $130.00
1700F05 ..... $275.00
1700F06 ..... $65.00
1700F07 ..... $175.00
1705A $4,495.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
1710J $1,795.00
Opt. 74 ..... $100.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
1711J $1,795.00
Opt. 74 ..... $100.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
1720 ..... $2,495.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
1720SCH $3,695.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
1721 ..... $2,495.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. PM $395.00
Opt. PN $395.00
1721SCH $3,695.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
1725 ..... $3,695.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
1730 ..... $2,495.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
1730D $3,995.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
1731 ..... $2,495.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. PM $395.00
Opt. PN $395.00
1735 ..... $2,995.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. BB $300.00
1735HD $5,995.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
174087600 ..... $430.00
174087800 ..... $500.00
174087900 ..... $500.00
1740A $4,595.00
Opt. 02 ..... $120.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
174112000 ..... $28.00
174134100 ..... $305.00
174136400 ..... $45.00
174138600 ..... $785.00
174138700 ..... $449.00
174138800 ..... $561.00
174142700 ..... $75.00
174142800 ..... $85.00
174145300 ..... $55.00
174149700 ..... $592.00
1741A $4,595.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
174232300 ..... $335.00
174232400 ..... $225.00
174276200 ..... $28.00
1745A $4,995.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
175084802 ..... $13.00
175084900 ..... $13.00
175084901 ..... $13.50
1750A $5,995.00
Opt. 02 ..... $125.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
175101701 ..... $11.50
1751A $5,995.00
Opt. 02 ..... $0.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
1755A $6,395.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
1760 ..... $5,095.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. SC $1,500.00
1761 ..... $5,095.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
Opt. SC $1,500.00
1765 ..... $5,495.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. SC $1,500.00
1780F02 ..... $395.00
1780F05 ..... $175.00
1780R $11,495.00
Opt. 74 ..... $200.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
1781R $11,495.00
Opt. 74 ..... $200.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
1910 ..... $8,950.00
Opt. 01 ..... $0.00
Opt. 03 ..... $0.00
Opt. 96 ..... $50.00
1910F00 ..... $350.00
195424000 ..... $3.70
195617600 ..... $9.15
196311302 ..... $12.50
196311303 ..... $9.75
196312101 ..... $3.70
196319801 ..... $4.20
196320001 ..... $12.25
196320100 ..... $12.75
196326801 ..... $62.00
196328600 ..... $10.25
196328700 ..... $13.00
196329500 ..... $7.90
196330200 ..... $17.25
196330500 ..... $15.75
196332100 ..... $21.00
196333700 ..... $12.00
196336300 ..... $24.00
196338200 ..... $17.75
196341000 ..... $40.00
198581000 ..... $50.00
198581800 ..... $34.00
198582600 ..... $275.00
198582700 ..... $470.00
198582800 ..... $595.00
198582900 ..... $550.00
198583000 ..... $430.00
198583100 ..... $260.00
198583200 ..... $135.00
198583300 ..... $125.00
198583400 ..... $105.00
198583500 ..... $105.00
198583600 ..... $195.00
198583700 ..... $295.00
198583800 ..... $328.00
198583900 ..... $110.00
198584000 ..... $340.00
198584100 ..... $285.00
198584200 ..... $345.00
198584300 ..... $328.00
198584400 ..... $320.00
198584500 ..... $270.00
198584600 ..... $275.00
198584700 ..... $275.00
198585000 ..... $470.00
198585100 ..... $370.00
198585200 ..... $265.00
198585300 ..... $295.00
200252000 ..... $22.00
200323201 ..... $10.50
200323202 ..... $24.00
200339700 ..... $34.00
200369601 ..... $75.00
200389701 ..... $19.00
202030200 ..... $820.00
204092501 ..... $1.35
204104900 ..... $1.50
206001500 ..... $2.75
206006000 ..... $7.50
206010000 ..... $14.50

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

206010500 ..... $2.10
206011400 ..... $5.50
206015304 ..... $185.00
206019300 ..... $95.00
206020000 ..... $2.25
206020900 ..... $7.25
206023003 ..... $42.00
206023004 ..... $165.00
206023301 ..... $32.00
206026510 ..... $22.00
206026511 ..... $22.00
206026512 ..... $22.00
206026513 ..... $22.00
206027010 ..... $175.00
206027011 ..... $20.00
206027012 ..... $148.00
206033601 ..... $62.00
206033701 ..... $49.00
206033801 ..... $80.00
206033903 ..... $190.00
206034101 ..... $750.00
206034201 ..... $63.00
206034301 ..... $50.00
206034401 ..... $85.00
206036400 ..... $5.50
206037800 ..... $22.00
206038000 ..... $83.00
206038200 ..... $89.00
206039200 ..... $23.00
206039300 ..... $23.00
206039800 ..... $240.00
206039903 ..... $485.00
206042600 ..... $44.00
206042700 ..... $68.00
206043800 ..... $300.00
206044600 ..... $8.50
206044700 ..... $12.00
206046300 ..... $20.00
214028300 ..... $2.45
214412500 ..... $2.25
214422700 ..... $6.25
22N50 ..... $425.00
260118902 ..... $27.00
26N50 ..... $1,275.00
2704 ..... $1,275.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
2705 ..... $410.00
2706 ..... $5,100.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
2707 ..... $4,500.00
Opt. 01 ..... $0.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
2711 ..... $9,630.00
Opt. 02 ..... $915.00
Opt. 03 ..... $860.00
Opt. 04 ..... $3,400.00
Opt. 05 ..... $4,530.00
Opt. 07 ..... $1,685.00
Opt. 08 ..... $830.00
Opt. 10 ..... $685.00
Opt. 15 ..... $295.00
Opt. 21 ..... $5,150.00
Opt. 30 ..... $270.00
Opt. 33 ..... $115.00
Opt. 34 ..... $630.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
2712 ..... $13,130.00
Opt. 04 ..... $3,340.00
Opt. 05 ..... $4,530.00
Opt. 07 ..... $1,680.00
Opt. 08 ..... $0.00
Opt. 10 ..... $680.00
Opt. 12 ..... $1,575.00
Opt. 14 ..... $640.00
Opt. 15 ..... $290.00
Opt. 20 ..... $3,425.00
Opt. 21 ..... $5,100.00
Opt. 30 ..... $265.00
Opt. 33 ..... $115.00
Opt. 34 ..... $620.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
27120A $25,950.00
Opt. 05 ..... $4,400.00
Opt. 10 ..... $670.00
Opt. 11 ..... –$3,400.00
Opt. 16 ..... –$2,800.00
Opt. 17 ..... –$5,000.00
2714 ..... $14,365.00
Opt. 03 ..... $0.00
Opt. 05 ..... $4,400.00
Opt. 07 ..... $1,650.00
Opt. 08 ..... $0.00
Opt. 15 ..... $290.00
Opt. 30 ..... $265.00
Opt. 33 ..... $115.00
Opt. 34 ..... $620.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
2715 ..... $15,900.00
Opt. 03 ..... $0.00
Opt. 05 ..... $4,400.00
Opt. 07 ..... $1,650.00
Opt. 08 ..... $0.00
Opt. 15 ..... $290.00
Opt. 30 ..... $265.00
Opt. 33 ..... $115.00
Opt. 34 ..... $620.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
2721A $6,850.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
2722A $6,850.00
Opt. 01 ..... $995.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
307504100 ..... $1.80
337277500 ..... $7.50
337277501 ..... $9.40
343100301 ..... $3.70
344004500 ..... $1.55
344004601 ..... $3.50
344046100 ..... $12.25
344046500 ..... $16.75
344046600 ..... $16.75
344046900 ..... $12.75
346019900 ..... $30.00
346026100 ..... $23.00
352035100 ..... $2.25
352067000 ..... $2.50
352105500 ..... $20.00
352105700 ..... $30.00
370A $26,400.00
Opt. 1R $595.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
371A $29,900.00
Opt. 95 ..... $150.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
437020900 ..... $3,460.00
437020901 ..... $5,600.00
437020905 ..... $3,380.00
437020906 ..... $5,480.00
60NF50 ..... $4,275.00
6502 ..... $6,285.00
650307600 ..... $350.00
650330200 ..... $1,660.00
650330300 ..... $4,330.00
650335600 ..... $4,265.00
650335700 ..... $985.00
728D $3,500.00
Opt. 01 ..... $0.00
Opt. 02 ..... $0.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
728E $8,500.00
Opt. 01 ..... –$2,500.00
Opt. 03 ..... $1,230.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
728F03F $1,230.00
728M $3,500.00
Opt. 03 ..... $1,230.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
73A270 ..... $3,650.00
Opt. X1 ..... $205.00
Opt. X2 ..... $340.00
Opt. X3 ..... $405.00
73A308 ..... $1,895.00
Opt. X1 ..... $100.00
Opt. X2 ..... $170.00
Opt. X3 ..... $205.00
73A451 ..... $1,350.00
Opt. 01 ..... $80.00
Opt. 02 ..... $80.00
Opt. 20 ..... $375.00
73A452 ..... $895.00
Opt. 01 ..... $80.00
Opt. 02 ..... $80.00
73A455 ..... $7,020.00
Opt. 2N $1,000.00
Opt. X1 ..... $385.00
Opt. X2 ..... $645.00
Opt. X3 ..... $775.00
73A541 ..... $2,790.00
Opt. 10 ..... $1,315.00
Opt. X1 ..... $135.00
Opt. X2 ..... $225.00
Opt. X3 ..... $270.00
73A642 ..... $257.00
73A734 ..... $187.00
73A850 ..... $750.00
73A851A $1,325.00
Opt. 01 ..... $145.00
Opt. 02 ..... $150.00
Opt. X3 ..... $150.00
73ASA5 ..... $750.00
73ASA7 ..... $800.00
760A $2,595.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
760D $2,595.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
760N $2,595.00
Opt. 74 ..... $100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
764 ..... $4,550.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
9206XT $2,900.00
Opt. 1X $3,150.00
Opt. 4C $980.00
Opt. 4X $1,900.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A4 ..... $0.00
Opt. A5 ..... $0.00
92A96UD $38,900.00
Opt. 1D ..... –$3,500.00
Opt. 1P $630.00
Opt. 2D ..... –$1,000.00
Opt. 4S $2,100.00

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92C02 ..... $2,200.00
92C96 ..... $15,200.00
Opt. 1D ..... –$3,600.00
Opt. 1P $625.00
Opt. 2D ..... –$1,050.00
Opt. 4S $2,100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92C96D $19,500.00
Opt. 1D ..... –$3,600.00
Opt. 1P $625.00
Opt. 2D ..... –$1,050.00
Opt. 4S $2,100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92C96SD $28,750.00
Opt. 1D ..... –$3,600.00
Opt. 1P $625.00
Opt. 2D ..... –$1,050.00
Opt. 4S $2,100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92C96XD $23,800.00
Opt. 1D ..... –$3,600.00
Opt. 1P $625.00
Opt. 2D ..... –$1,050.00
Opt. 4S $2,100.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92DM04A $2,500.00
Opt. 1D ..... –$650.00
92DM06A $2,500.00
Opt. 1D ..... –$650.00
Opt. 1S $0.00
92DM08A $2,500.00
Opt. 1D ..... –$650.00
Opt. 1S $0.00
92DM09B $3,950.00
Opt. 1D ..... –$750.00
Opt. 1S $0.00
92DM10A $3,950.00
Opt. 1D ..... –$750.00
92DM11 ..... $3,950.00
Opt. 1D ..... –$750.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM12A $4,950.00
Opt. 01 ..... $175.00
Opt. 1D ..... –$750.00
92DM13A $6,000.00
Opt. 1D ..... –$1,500.00
92DM14 ..... $6,000.00
Opt. 01 ..... $1,200.00
Opt. 1D ..... –$1,500.00
Opt. 1S $1,500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM16 ..... $4,950.00
92DM16A $8,950.00
Opt. 1D ..... –$3,000.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM17 ..... $4,950.00
Opt. 1D ..... –$750.00
Opt. 2S $0.00
92DM18 ..... $4,950.00
Opt. 01 ..... $1,200.00
Opt. 02 ..... $1,500.00
Opt. 1D ..... –$1,500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM19 ..... $4,950.00
Opt. 01 ..... $1,200.00
Opt. 1D ..... –$1,500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM31B $3,950.00
Opt. 1D ..... –$750.00
Opt. 1S $0.00
Opt. 2S $0.00
92DM33B $3,950.00
Opt. 1D ..... –$750.00
Opt. 1S $0.00
92DM34A $4,950.00
Opt. 1D ..... –$750.00
92DM35A $4,950.00
Opt. 04 ..... $1,900.00
Opt. 1D ..... –$1,950.00
92DM36 ..... $6,000.00
Opt. 1D ..... –$750.00
92DM37 ..... $3,500.00
92DM55 ..... $3,500.00
Opt. 1D ..... –$1,500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM56 ..... $4,950.00
Opt. 1D ..... –$750.00
92DM72A $4,950.00
Opt. 1D ..... –$750.00
92DM73 ..... $4,950.00
Opt. 1D $0.00
92DM74 ..... $4,950.00
Opt. 1D ..... –$750.00
Opt. 2S $0.00
92DM75A $4,950.00
Opt. 1D ..... –$750.00
Opt. 2S $250.00
92DM77A $4,950.00
Opt. 1D ..... –$750.00
92DM81 ..... $3,500.00
Opt. 1D ..... –$650.00
Opt. 2S $0.00
92DM82 ..... $2,500.00
Opt. 01 ..... $1,200.00
Opt. 1D ..... –$500.00
Opt. 1S $500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM901 ..... $2,500.00
Opt. 1D ..... –$550.00
92DM902 ..... $2,500.00
Opt. 1D ..... –$200.00
92DM911 ..... $12,000.00
Opt. 1D ..... –$8,000.00
92DM912 ..... $3,500.00
Opt. 1D ..... –$650.00
Opt. 2S $0.00
Opt. 3S $0.00
92DM913 ..... $2,500.00
Opt. 1D ..... –$550.00
92DM914 ..... $3,500.00
Opt. 1D ..... –$750.00
92DM916 ..... $3,500.00
Opt. 1D ..... –$750.00
92DM920 ..... $3,500.00
Opt. 1D ..... –$750.00
Opt. 2S $0.00
92DM921 ..... $3,500.00
Opt. 1D ..... –$1,950.00
92DM923 ..... $3,500.00
Opt. 1D ..... –$1,950.00
92DM925 ..... $3,500.00
Opt. 1D ..... –$750.00
Opt. 2S $0.00
92DM926 ..... $1,000.00
Opt. 1D ..... –$750.00
92DM927 ..... $1,000.00
Opt. 1D ..... –$750.00
92DM930 ..... $8,200.00
Opt. 1D ..... –$7,700.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92DM93A $3,500.00
Opt. 1A $750.00
Opt. 1D ..... –$750.00
Opt. 2S $0.00
92DM94 ..... $4,950.00
Opt. 01 ..... $1,200.00
Opt. 1D ..... –$1,500.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92F11 ..... $450.00
92F19 ..... $490.00
92F1B $3,550.00
92FM04A $250.00
92FM06A $250.00
92FM08A $250.00
92FM09A $250.00
92FM09B $250.00
92FM10 ..... $250.00
92FM10A $250.00
92FM11 ..... $250.00
92FM12 ..... $250.00
92FM12A $250.00
92FM13A $250.00
92FM14 ..... $250.00
92FM16 ..... $250.00
92FM16A $250.00
Opt. 01 ..... $5,700.00
Opt. A1 ..... $0.00
Opt. A2 ..... $0.00
Opt. A3 ..... $0.00
Opt. A5 ..... $0.00
92FM17 ..... $250.00
92FM18 ..... $250.00
92FM31A $250.00
92FM31B $250.00
92FM33A $250.00
92FM33B $250.00
92FM34A $250.00
92FM35A $250.00
92FM36 ..... $250.00
92FM55 ..... $250.00
92FM56 ..... $250.00
92FM72A $250.00
92FM73 ..... $250.00
92FM74 ..... $250.00
92FM75A $250.00
92FM77A $250.00
92FM81 ..... $250.00
92FM901 ..... $250.00
92FM902 ..... $250.00
92FM911 ..... $250.00
92FM912 ..... $250.00
92FM913 ..... $250.00
92FM914 ..... $250.00
92FM916 ..... $250.00
92FM920 ..... $250.00
92FM921 ..... $250.00
92FM923 ..... $250.00
92FM925 ..... $250.00
92FM926 ..... $250.00
92FM930 ..... $250.00
92FM93A $250.00
92FM94 ..... $250.00
92FMPA $250.00
92FXNET $12,650.00
Opt. 18 ..... $375.00
Opt. 4X $1,900.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92FXSE $10,150.00
Opt. 18 ..... $375.00
Opt. 4X $1,900.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92LANP $1,600.00
92LANSE $980.00
Opt. 01 ..... $1,600.00
92PA $2,600.00
92PORT $1,000.00
92QTURN $5,500.00
92S16 ..... $7,800.00
Opt. 1D ..... –$1,550.00
Opt. 2S $3,700.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92S32 ..... $10,050.00
Opt. 1D ..... –$3,100.00
Opt. 1S $1,850.00
Opt. 2S $3,700.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92SIMLK $1,100.00
92SSR $800.00
92SSU $1,600.00
92SWU $1,300.00
Opt. 01 ..... $0.00
92SX109 ..... $10,500.00
Opt. 09 ..... $2,700.00
Opt. 11 ..... $980.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92SX118 ..... $13,900.00
Opt. 09 ..... $5,350.00
Opt. 95 ..... $150.00
Opt. 96 ..... $50.00
92XTERM $3,150.00
950035900 ..... $0.88
950053000 ..... $35.97
950053200 ..... $0.42
950095200 ..... $0.36
950100100 ..... $1.26
950100800 ..... $0.16
950108100 ..... $0.15
950127200 ..... $68.75
950177700 ..... $32.70
950189000 ..... $446.00
950200600 ..... $605.00
950335200 ..... $9.15
950363200 ..... $22.85
950365100 ..... $10.77
950374700 ..... $0.88
950374800 ..... $0.88
950379900 ..... $0.31
950399700 ..... $19.80
950405100 ..... $1.71
950409100 ..... $0.05
950413500 ..... $53.60
950413600 ..... $53.60
950413700 ..... $53.60
950413800 ..... $53.60
950413900 ..... $53.60
950414000 ..... $53.60
950414100 ..... $53.60

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Products and Price Listing

PRICE LIST

950417400	$26.35
950420200	$0.25
950435700	$8.97
950482700	$0.05
950501500	$30.00
950506100	$68.28
950524000	$288.75
950526600	$4.05
950546700	$0.26
950568800	$3.48
950569700	$40.00
950602200	$200.00
950602300	$15.00
950829200	$75.00
950854100	$350.00
950866300	$1.65
950867600	$18.00
950881800	$15.00
9617A3	$2,660.00
9617C3	$2,300.00
9617F3	$2,895.00
9617K3	$2,100.00
9617R3	$3,500.00
9617S3	$3,100.00

49A-10733-1

[1] Contact your local Tektronix representative for price information.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Please send additional information on: _____

_____

(Please type, print, or write legibly.)

_____

_____

Phone (_____)_____ Ext. _____

Name_____

Title _____

Dept./Mail Station _____

Company_____

Address _____

City _____ State _____ Zip _____

MBA-MW6024-01

Also, please send:

VXI Products Catalog
- ❑ CD-ROM 11830
- ❑ 3.5 inch Floppy 11831

- ❑ Television Products Catalog 11602
- ❑ Basic Instruments Information 11828
- ❑ Logistics Data Book 11829
- ❑ GSA Price List 11185
- ❑ Reserve a 1999 Catalog
- ❑ Remove my name from your mail list

Tektronix

We value your input!

PLEASE FILL OUT THIS SURVEY

1. What is your primary source of information about Tektronix products?
   ❑ Catalog ❑ Salesperson ❑ Data Sheets ❑ Colleagues ❑ Advertising ❑ WWW ❑ Magazine Articles
2. What is your primary use of the catalog?
   ❑ Browsing ❑ When Buying ❑ Research ❑ Other _____
3. Do you have access to a CD-ROM drive? ❑ Yes ❑ No
   If yes, would you prefer a CD-ROM based catalog? ❑ Yes ❑ No
4. Do you have access to the World Wide Web?
   ❑ Yes – Own Computer ❑ Yes – Shared Computer ❑ No
5. Why do you use the World Wide Web?
   ❑ Browsing ❑ When Buying ❑ Research ❑ Other _____
6. How often do you access the World Wide Web?
   ❑ Daily ❑ Weekly ❑ Monthly ❑ Seldom
7. Have you been to the Tektronix WWW site? ❑ Yes ❑ No
   If yes, did you find it: ❑ Easy to use ❑ Difficult to use
   Suggestions: _____

Thank you for your help!

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 126 PITTSFIELD MA

POSTAGE WILL BE PAID BY ADDRESSEE

TEKTRONIX INC
PO BOX 1520
PITTSFIELD MA 01202-9864

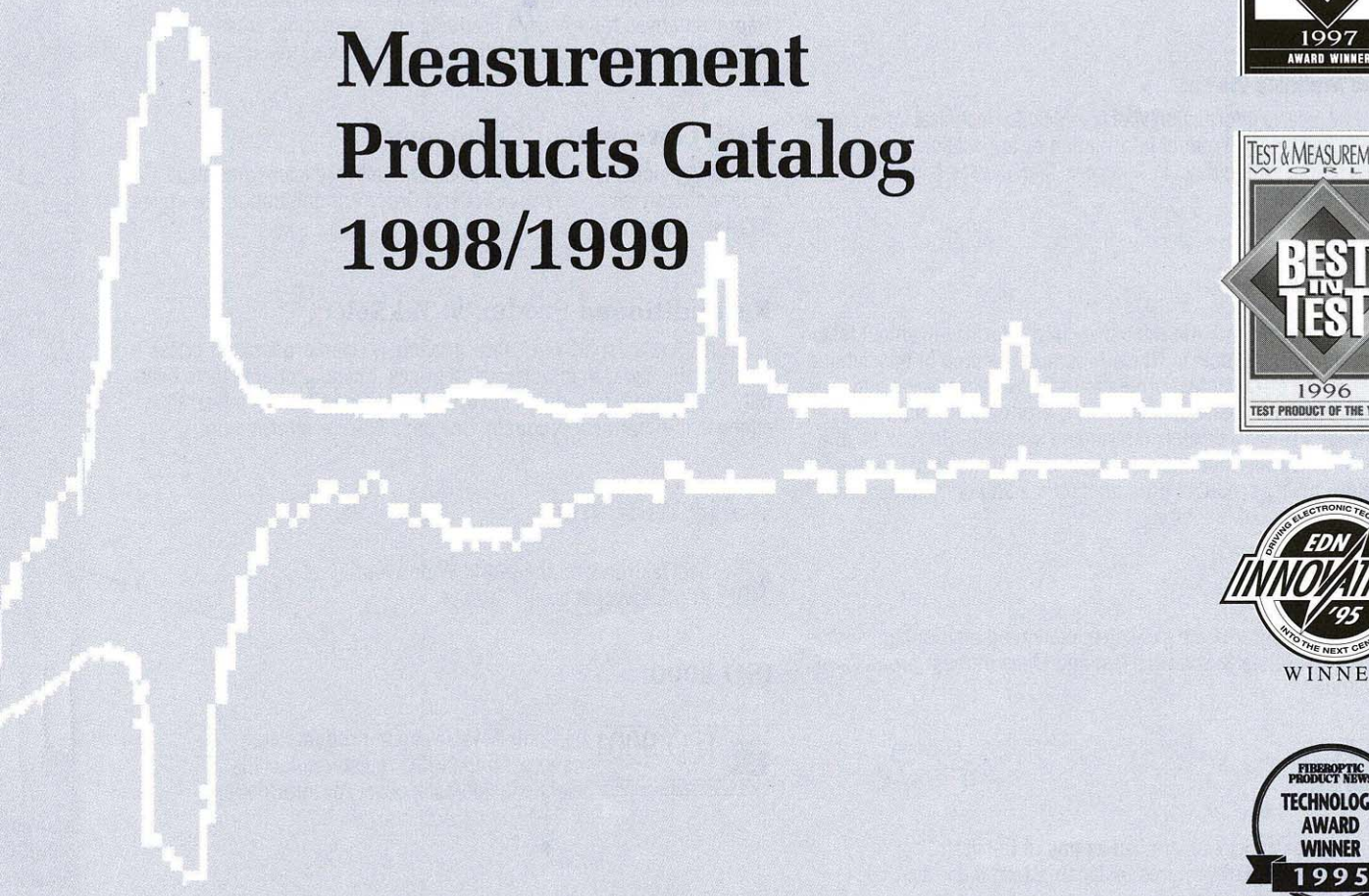
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 126 PITTSFIELD MA

POSTAGE WILL BE PAID BY ADDRESSEE

TEKTRONIX INC
PO BOX 1520
PITTSFIELD MA 01202-9864

Tektronix



Measurement Products Catalog 1998/1999

TEST & MEASUREMENT WORLD BEST IN TEST 1997 AWARD WINNER

TEST & MEASUREMENT WORLD BEST IN TEST 1996 TEST PRODUCT OF THE YEAR

EDN INNOVATION '95 DRIVING ELECTRONIC TECHNOLOGY INTO THE NEXT CENTURY WINNER

FIBEROPTIC PRODUCT NEWS TECHNOLOGY AWARD WINNER 1995

R&D 100

ELECTRONIC PRODUCTS 1996 PRODUCT OF THE YEAR AWARD

Tektronix: A Lifetime of Value

Customer Support

No other test and measurement supplier can match the remarkable depth of customer support offered by Tektronix. We offer technical support, service training, and service warranties. For additional information and the Tektronix representative nearest you, see the listing in the back of this catalog.

TEKFAX

Literature Available Via Fax

You can now receive information via fax—ideal for technical information you need immediately. Product information or application notes are available any time of the day via Tektronix TekFAX. See page 652 for complete information.

ADVANTEST

In 1993 Tektronix became the exclusive distributor of Advantest test and measurement products in North America. Featured in this catalog are a wide-range of Advantest products in the RF/Microwave and Telecommunications areas. These exciting products are highly complementary to the Tektronix instrument portfolio. So look for the Advantest logo throughout this catalog to identify new high-performance, high-quality products from another leading company in the Test and Measurement industry:

ROHDE&SCHWARZ

In 1993 Tektronix became the exclusive, marketing distribution service and support for Rohde & Schwarz Test and Measurement products in North America.

SONY Tektronix

In 1965, Sony/Tektronix was created as one of the first Japanese/American joint ventures in Japan. Since then, the company has been distributing every Tektronix products to Japanese customers including Test and Measurement instruments, Color Printers, Video Networking products, Computer Graphic Terminals. Beside these activities, Sony/Tektronix has originally designed, manufactured and distributed innovative T&M products to worldwide customers through Tektronix sales channel. These instruments such as Arbitrary Waveform Generators, Data Generators and Curve Tracers can be seen throughout this catalog.

Tektronix Sales/Service Offices

We have a worldwide network of sales and service offices. To find the office nearest you, see the listing in the back of this catalog.

Distributor & Manufacturers Representatives

We have Authorized Tektronix Distributors and Manufacturers Representatives for selective products and geographic areas. To find the office nearest you, see the listing in the back of this catalog.

U. S. Government Customers

Federal Agencies should obtain price and delivery from, and place orders directly with, Tektronix Federal Order Administration. See page 642 for information.

Reconditioned Products: TekSelect™

Tektronix has a variety of quality, previously used products at prices significantly lower than our catalog prices. These products have been fully refurbished, tested and calibrated. Each comes with a warranty equivalent to our new products. See page 650 for information.

World Wide Web

See Tektronix on the World Wide Web:
http://www.tek.com

ISO 9000

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities. See the inside back cover for information.

ISO Certification

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ISO CERTIFICATION

Tektronix has chosen to become ISO9001 certified in order to demonstrate to our customers our commitment to being a quality vendor. By passing the audit, Tektronix assures that behind our quality products and services is a well-defined, systematic approach to quality-design to delivery. This certificate reinforces Tektronix' status as a deliverer of technology and quality in products.

To achieve, ISO 9001 certification you need to prove to a third party, known as the quality system registrars, that you meet three requirements:

1. Leadership
2. Involvement
3. Quality in Line Organizations and Quality System Infrastructure

The ISO 9001 standard establishes a minimum requirement for the above and starts transitioning the company from a traditional inspection-oriented quality system to one based on partnership for continuous improvement. This concept is key in that Tektronix no longer focuses on inspection but on individual processes.

Tektronix' quality management system are based on three objectives:

1. Customer oriented quality–the aim is to improve customer satisfaction.
2. Quality is determined by people–the aim is to improve the internal organization and cooperation between staff members.
3. Quality is continuous improvement–the aim is to continuously improve the internal organization and the competitive position.

KEMA cimei

CERTIFICATE

TEKTRONIX, INC.
TEST AND MEASUREMENT DIVISION
BEAVERTON, OREGON

ISO 9001

KEMA cimei

CERTIFICATE

TEKTRONIX, INC.
TEST AND MEASUREMENT CUSTOMER SERVICES
BEAVERTON, OREGON

ISO 9001

Tektronix ISO